EDEXCEL GCSE BIOLOGY

BIOLOGY



EXAM QUESTION PACK

UNIT B3 HIGHER TIER 5BI3H PAPERS

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Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

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 in a box ☒.
If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

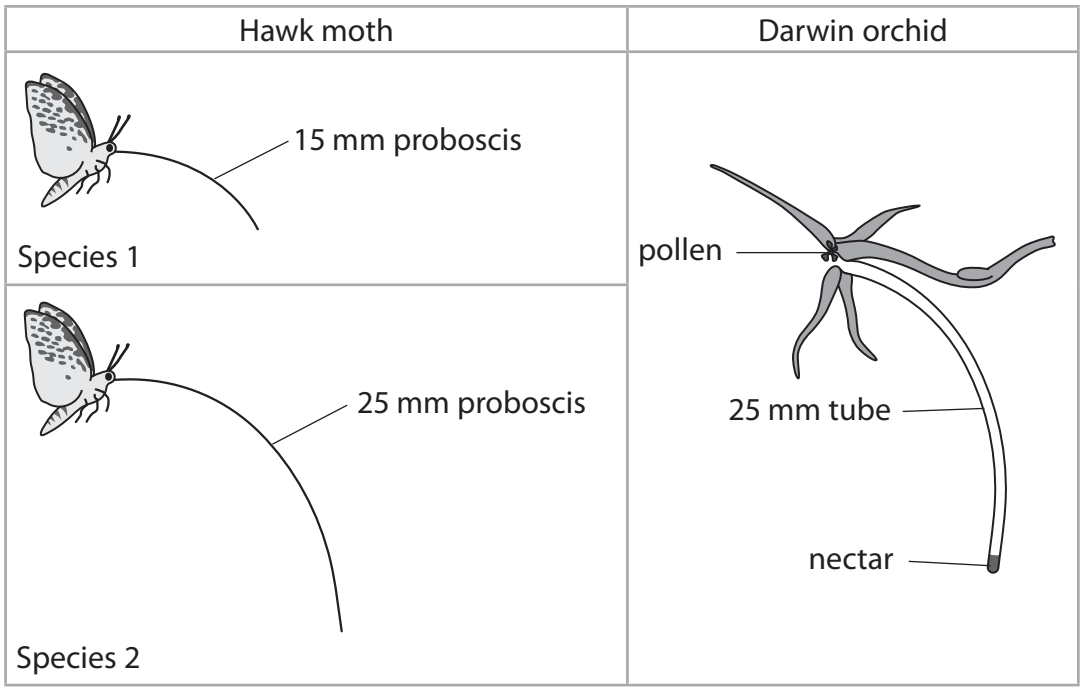
Co-evolution

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)

DO NOT WRITE IN THIS AREA
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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)

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

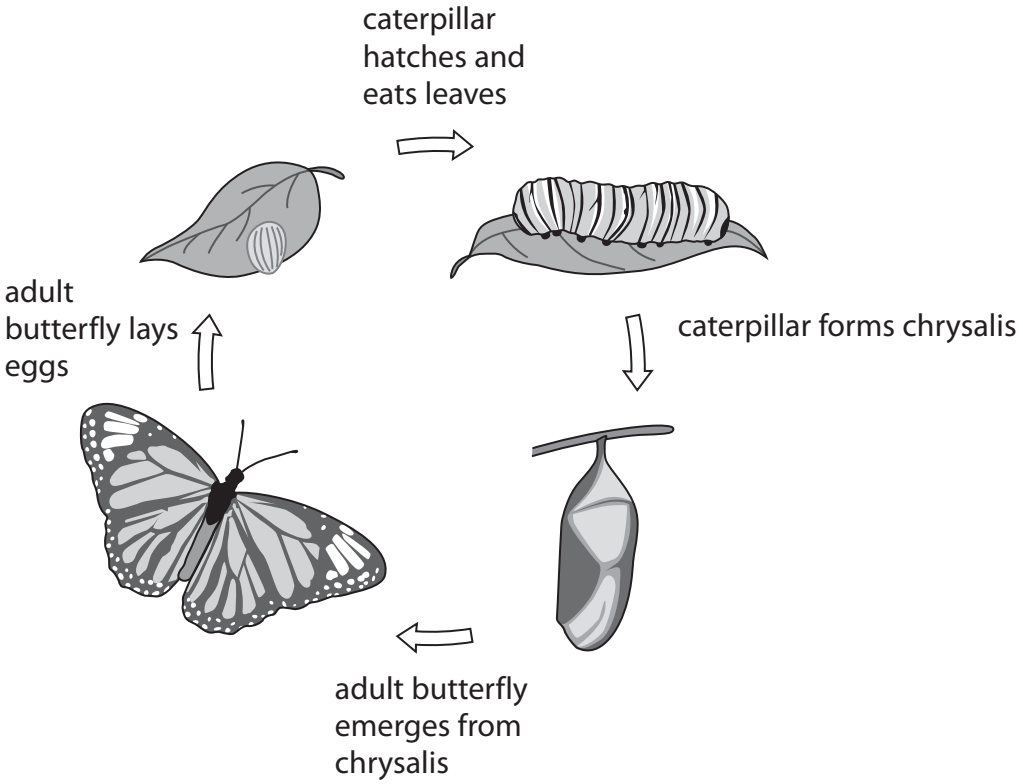
(1)

(Total for Question 1 = 7 marks)

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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)

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(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 (☒) 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)

(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)

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

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

(2)

(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)

.....

.....

.....

.....

(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 .....

DO NOT WRITE IN THIS AREA
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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

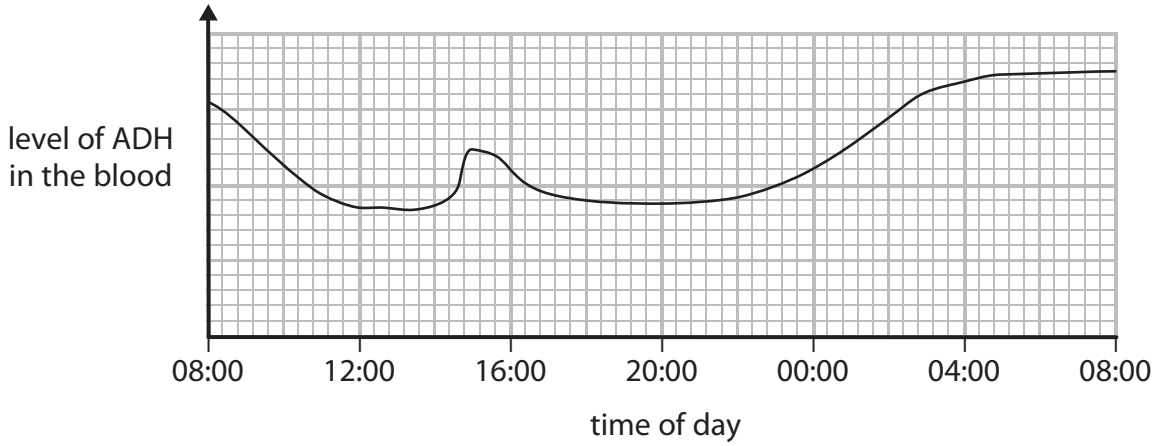
☒ **A** increasing its permeability to water, decreasing urine production

☒ **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)

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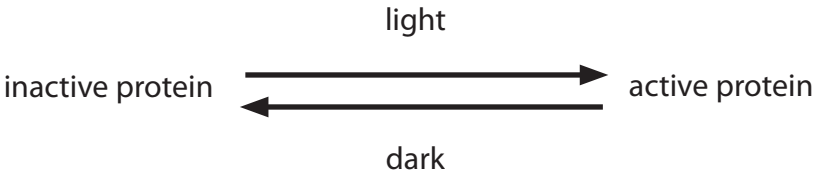
(Total for Question 3 = 10 marks)

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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 (☒) 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)

(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)

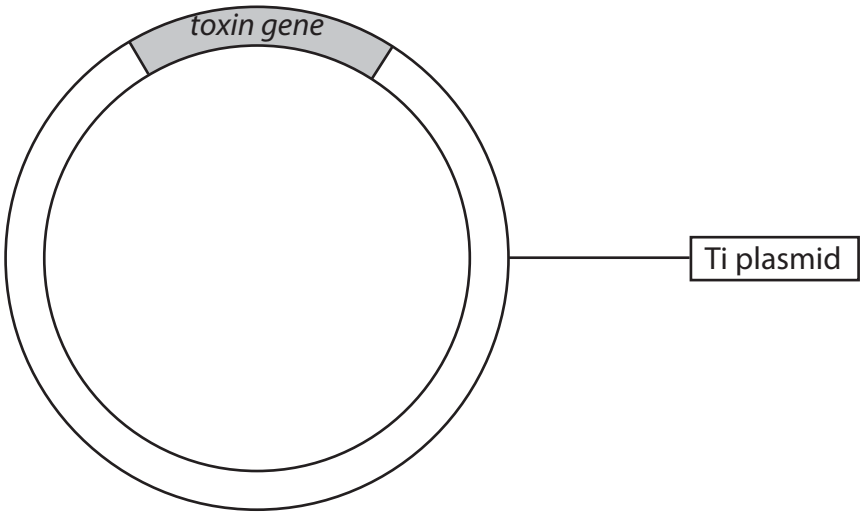
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(b) Explain why biofuels can be described as carbon neutral.

(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)

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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

DO NOT WRITE IN THIS AREA

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

(2)

.....

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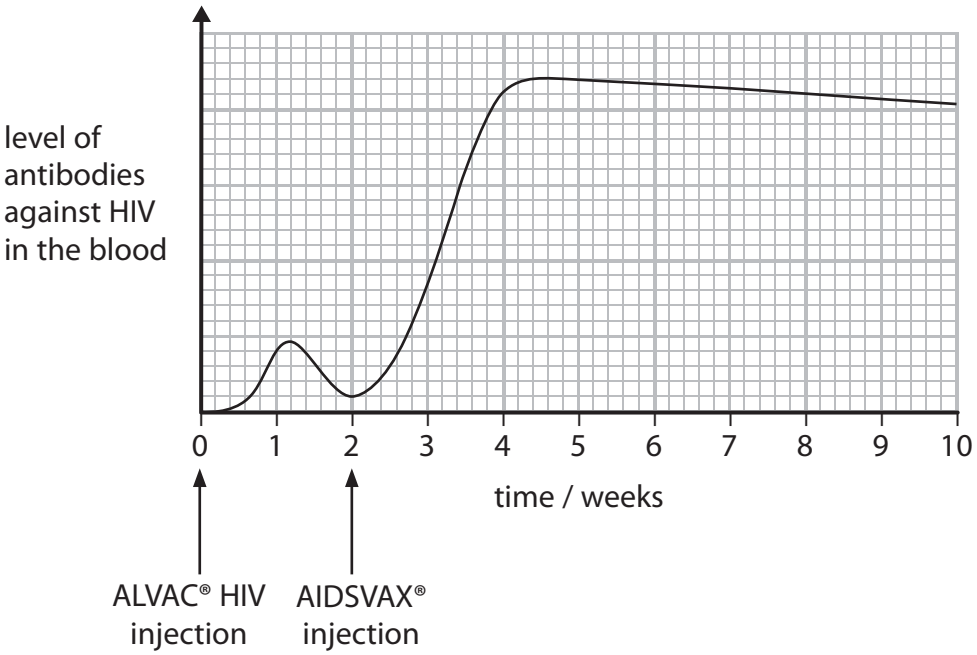
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*(b) The level of antibodies against HIV in the blood of an immunised volunteer was measured during the clinical trial.



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 (☒) in the box next to your answer.

(1)

☒ **A** sucrose ⟶ glucose + lactose

☒ **B** glucose ⟶ sucrose + fructose

☒ **C** sucrose ⟶ glucose + fructose

☒ **D** glucose ⟶ lactose + sucrose

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

(1)

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

(4)

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*(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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Mark Scheme (Results)

Summer 2017

Pearson Edexcel GCSE

In Biology (5BI3H) Paper 01

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Summer 2017
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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Acceptable answers	Marks
1 (a) (i)	• species 2 (1) • it can **reach the nectar**/proboscis is the same length as the tube (1)	ignore just feed on the nectar /has a longer proboscis	(2)

Question number	Answer	Marks
1 (a)(ii)	**C** both species 1 and species 2 **The only correct answer is C** ***A** is not correct because species 2 can also pollinate the orchid* ***B** is not correct because species 1 can also pollinate the orchid* ***D** is not correct because species 1 and 2 can pollinate the orchid*	(1)

Question number	Answer	Marks
1 (b) (i)	A description including three of the following; • a **mutation** occurs in {orchid/hawk moth} (1) • the hawk moth can feed on the nectar (1) • orchid is pollinated by the hawk moth (1) • **both** orchid and hawk moth survive and {reproduce/pass on genes/pass on characteristic} (1)	(3)

Question number	Answer	Acceptable answers	Marks
1 (b)(ii)	less competition for nectar / less competition for food / only organism able to feed (1)	accept exclusive food source ignore get more food/they can get the nectar	(1)

Total for question 1 = 7 marks

Question number	Answer	Acceptable answers	Marks
2 (a)	An explanation linking the following: • **eggs** less likely to be {seen/found} by predators/hides the eggs (1) • increased chance of {survival/caterpillars hatching}/eggs less likely to be eaten (1)	protection of the eggs from the environment e.g. sun/rain ignore protection unqualified ignore references to food supply	(2)

Question number	Answer	Acceptable answers	Marks
2 (b) (i)	deter {predators/birds/animals} / stops the caterpillars getting eaten / survive for longer (1)	ignore larger food supply	(1)

Question number	Answer	Marks
2 (b) (ii)	**B** to relieve symptoms of disease **The only correct answer is B** ***A** is not correct because they are not hormones* ***C** is not correct because they are not used to produce hybridoma cell* ***D** is not correct because they are not used medically as antigens*	(1)

Question number	Answer	Acceptable answers	Marks
2 (c)	An explanation linking the following: • increased camouflage/decrease chance of predator spotting the butterfly/decreases surface area (1) • increased chance of survival/less likely to be eaten (1)	accept makes them less visible accept innate behaviour accept as a warning to other **butterflies**	(2)

Question number	Answer	Acceptable answers	Marks
2 (d) (i)	operant (1)	accept phonetically correct spellings	(1)

Question number	Answer	Acceptable answers	Marks
2 (d) (ii)	An description of the following: • **{repeated/frequent}** waving of flags near the horse / exposure to flags over a long period of time (1) • horse learns not to respond to a {neutral stimulus/flag waving}/learn to ignore the flags (1)	accept wave flags when they are young/ wave flags during training learn that flag waving is not a danger/threat ignore references to rewards	(2)

Total for question 2 = 9 marks

Question number	Answer	Acceptable answers	Marks
3 (a) (i)	An explanation linking the following: • X or Y chromosome from the {sperm/male/father} (1) • XX female, XY male (1)	accept correctly drawn XY Punnett square	(2)

Question number	Answer	Marks
3 (a) (ii)	**A** corpus luteum **The only correct answer is A** ***B*** *is not correct because lymphocytes do not produce progesterone* ***C*** *is not correct because the pituitary gland doesn't produce progesterone* ***D*** *is not correct because the hypothalamus doesn't produce progesterone*	(1)

Question number	Answer	Marks
3 (b)	<table><tr><td></td><td>X^H</td><td>Y</td></tr><tr><td>X^H</td><td>X^HX^H</td><td>X^HY</td></tr><tr><td>X^h</td><td>X^HX^h</td><td>X^hY</td></tr></table> parents gametes (1) offspring genotypes (1) 25% / 0.25 / 1 in 4 / ¼ / 1:3 (1)	(3)

Question number	Answer	Marks
3 (c) (i)	**A** increasing its permeability to water, decreasing urine production **The only correct answer is A** ***B*** *is not correct because ADH does not decrease the permeability of the collecting duct* ***C*** *is not correct because ADH doesn't increase urine production* ***D*** *is not correct because ADH does not decrease the permeability of the collecting duct or increase urine production*	(1)

Question number	Answer	Acceptable answers	Marks
3 (c) (ii)	lack of fluid intake/ dehydration/exercise/low water content (in the blood) (1)	accept drug intake/ sweating ignore thirsty ignore references to food	(1)

Question number	Answer	Acceptable answers	Marks
3 (d)	A description including the following • from {amino acids/protein} (1) • in the liver (1)	accept deamination	(2)

Total for question 3 = 10 marks

Question number	Answer	Marks
4 (a) (i)	**C** photoperiodicity **The only correct answer is C** ***A** is not correct because it is not a behaviour response* ***B** is not correct because plants do not show conditioning to different day lengths* ***D** is not correct because inheritance is not a response to different day lengths*	(1)

Question number	Answer	Acceptable answers	Marks
4 (a) (ii)	An explanation linking the following: • less (active protein) (1) • active protein (1)	active protein converted to inactive protein = 2 marks ignore inactive protein promotes flowering	(2)

Question number	Answer	Acceptable answers	Marks
4 (a) (iii)	grow it in high light levels/grow during long days/ grow in more hours of daylight (1)	accept grow in high light intensity	(1)

Question number	Answer	Acceptable answers	Marks
4 (b)	Explanation linking the following • remove carbon dioxide when **photosynthesising** (1) • release carbon dioxide {during combustion/during burning/when used} (1)	accept idea that they don't add to overall carbon dioxide when burnt	(2)

Question number	Answer	Acceptable answers	Marks
4 (c)	An explanation including four of the following: • insert the plasmid into a {vector/plant pathogen/bacterium} (1) • *Agrobacterium (tumefaciens)* (1) • infect {plants/leaf discs} (1) • {toxin gene/plasmid} incorporated into the **plant DNA** (1) • {crown gall/tumour} forms (1) • isolate infected cells (1)	accept *A. tumefaciens* accept inject/invades using a gene gun to insert the plasmid into the plant **cells** = 2 marks	(4)

Total for question 4 = 10 marks

Question number	Answer	Acceptable answers	Marks
5 (a) (i)	to compare with vaccinated group/control group/as a control	accept to see if the {antigen/immunisation} is effective	(1)

Question number	Answer	Acceptable answers	Marks
5 (a) (ii)	8000 x 0.00625 = 50 (1) 8000 x 0.00925 = 74 (1) 74-50 = 24 OR 0.925 – 0.625 = 0.3 (1) 0.3 /100 = 0.003 (1) 0.003 x 8000 = 24	full marks for correct answer without calculation award 2 marks for 48 if correct working shown for group sizes of 16 000	(3)

Question number	Answer	Acceptable answers	Marks
5 (a) (iii)	An explanation linking the following: • immunised people still caught HIV /only caused a small reduction in infection rates (1) • so people were not immune (1)	accept percentage of people with HIV after the immunisation is not 0%	(2)

Question Number		Indicative Content	Mark
QWC	***5(b)**	An explanation to include some of the following points Graph interpretation • delay in Ab production after ALVAC/first injection • increased Ab production • peak after 1 week • greater increase after AIDSVAX/second injection • approximately 5 time greater/larger number produced • maintained Ab level after booster • gradual decline Immune Response • definition of immunisation/ harmless pathogen/antigen • production of antibodies from lymphocytes • primary response • production of memory lymphocytes • secondary immune response by memory lymphocytes	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• A simple explanation of the level of antibody in the blood OR the immune response • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• A detailed explanation that includes a comparison of antibody production OR a detailed explanation of the immune response OR a simple explanation of antibody levels linked to the immune response • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• A detailed explanation of the level of antibody production linked to the time taken for production of antibodies during the immune response including the role of lymphocytes producing antibodies and memory lymphocytes • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total for question 5 = 12 marks

Question number	Answer	Marks
6 (a) (i)	**C** sucrose ⟶ glucose + fructose **The only correct answer is C** ***A** is not correct because lactose is not a product of the reaction* ***B** is not correct because it doesn't catalyse this reaction* ***D** is not correct because it doesn't catalyse this reaction*	(1)

Question number	Answer	Acceptable answers	Marks
6 (a) (ii)	*Saccharomyces (cerevisiae)*	accept phonetically correct spellings	(1)

Question number	Answer	Acceptable answers	Marks
6 (b)	An explanation linking the following • chymosin (1) • (added to) milk (1) • (milk) incubated /aseptic conditions (1) • clots/curdles/separates the curds and whey/coagulates (the milk) (1) • which is compressed to form cheese (1)	 ignore references to pasteurisation/sterile conditions ignore thicken/solidify accept curd used to make cheese	(4)

Question Number		Indicative Content	Mark
6(c)*		A explanation to include some of the following points immobilised enzymes • enzyme mixed with alginate • alginate beads formed by droplets into calcium chloride solution • beads collected and placed in a column/syringe Lactose free milk • lactase • milk filtered over the alginate beads • lactose in the milk converted into glucose and galactose • immobilised enzymes can be reused • lactose free milk produced without enzyme present	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• A limited explanation of the production of immobilised enzymes or the role of enzymes in the production of lactose-free milk • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• A simple explanation of the use of immobilised enzymes in the production of lactose-free milk OR a detailed explanation of the role of lactase in the production of lactose free milk OR a detailed explanation of the production of immobilised enzymes • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• A detailed explanation of the role of immobilised enzymes in the production of lactose-free milk including the role of lactase and the use of beads containing the enzyme • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total for question 6 = 12 marks

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Biology

Unit B3: Using Biology

Higher Tier

Monday 20 June 2016 – Morning
Time: 1 hour

Paper Reference
5BI3H/01

You must have:
Calculator, ruler

Total Marks

Instructions

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Turn over ▶

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Answer ALL questions

Some questions must be answered with a cross in a box ☒.
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Biofuels

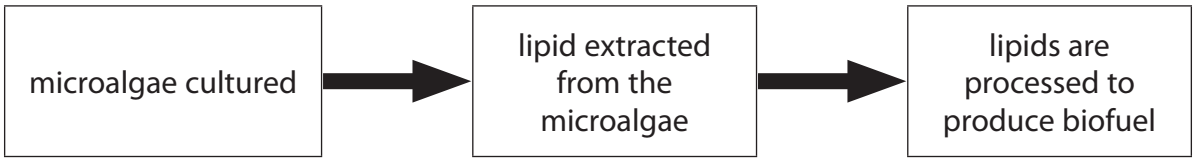
1 Photosynthetic microalgae and other plants can be used to produce biofuels.

Microalgae grow in water.

The photograph shows microalgae being cultured in closed systems.



The flow diagram shows how biofuels are produced from microalgae.



(a) (i) Suggest one advantage of using microalgae rather than other plants to make biofuels.

(1)

.....

(ii) Name the gas that would be supplied to the closed system to allow the microalgae to grow.

(1)

.....

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(iii) Closed systems require aseptic precautions.

Explain the benefit of maintaining aseptic conditions.

(2)

(iv) Suggest two other factors that would need to be maintained in a closed system to allow the microalgae to grow.

(2)

1 .....

2 .....

(b) Biofuels can be used instead of fossil fuels as an energy resource.

Describe the advantages of using biofuels rather than fossil fuels.

(2)

(Total for Question 1 = 8 marks)

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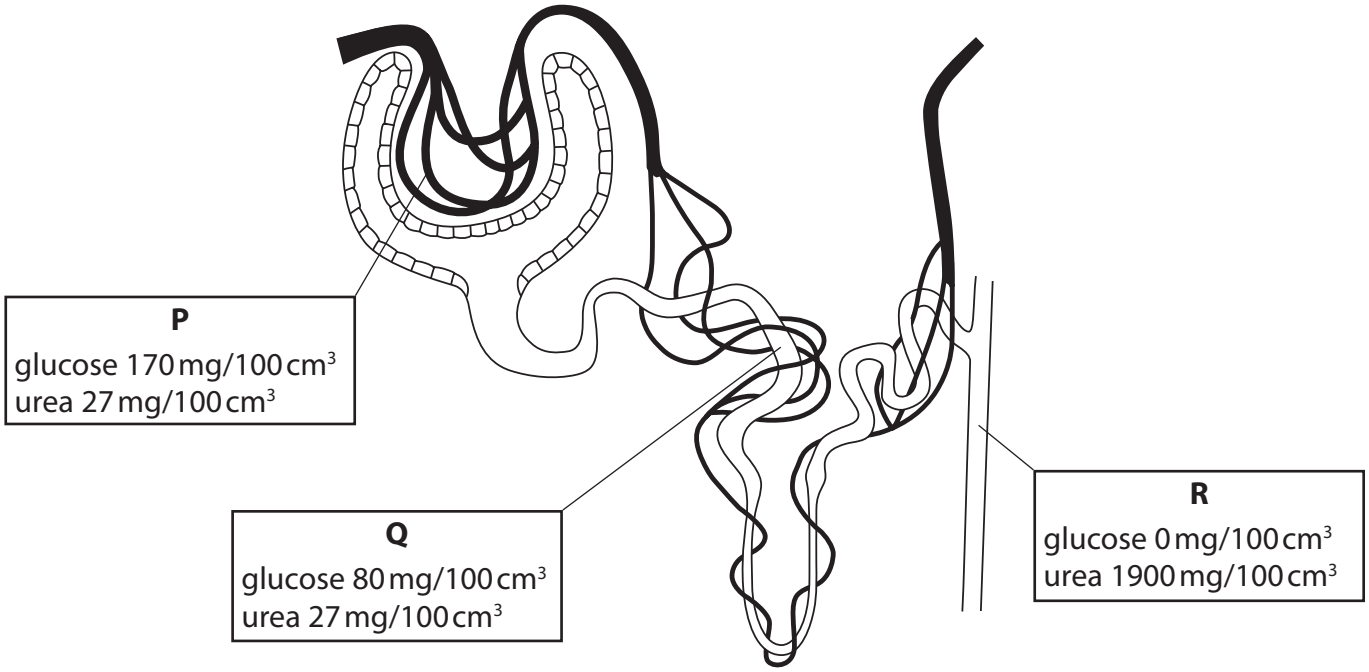
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The kidney

2 Glucose and urea are transported in the blood to nephrons.

The diagram shows a nephron with the glucose and urea concentrations at locations labelled **P**, **Q** and **R**.



(a) (i) Calculate the percentage decrease in glucose concentration between location **P** and location **Q**.

(2)

..... %

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(ii) Describe how glucose is removed from the nephron.

(2)

(iii) Explain the change in the concentration of urea between location **Q** and location **R**.

(2)

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

Urea enters the nephron through the

(1)

☒ **A** Bowman's capsule

☒ **B** bladder

☒ **C** collecting duct

☒ **D** loop of Henlé

(ii) Which hormone controls the permeability of the collecting duct?

(1)

.....

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

Urine is transported from the bladder through the

(1)

☒ **A** renal artery

☒ **B** renal vein

☒ **C** ureter

☒ **D** urethra

(Total for Question 2 = 9 marks)

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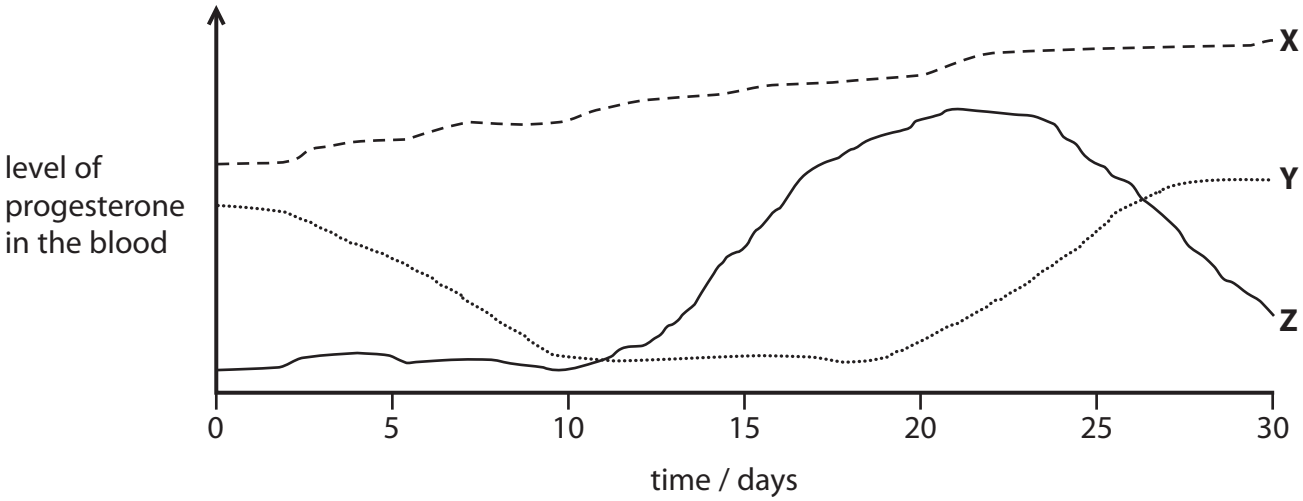
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Hormones

3 Progesterone is a hormone involved in the control of the menstrual cycle.

The graph shows the level of progesterone in the blood of three women, labelled **X**, **Y** and **Z**, for 30 days.



(a) (i) Which stage of the menstrual cycle is occurring for person **Y** on day 10?

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

(1)

☒ **A** menstruation

☒ **B** ovulation

☒ **C** uterus lining thickening

☒ **D** fertilisation

(ii) Suggest a reason for the increasing progesterone level of person **X**.

(1)

(iii) Explain the role of progesterone in the menstrual cycle.

(3)

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(iv) Which hormone is responsible for triggering the release of the egg in the menstrual cycle?

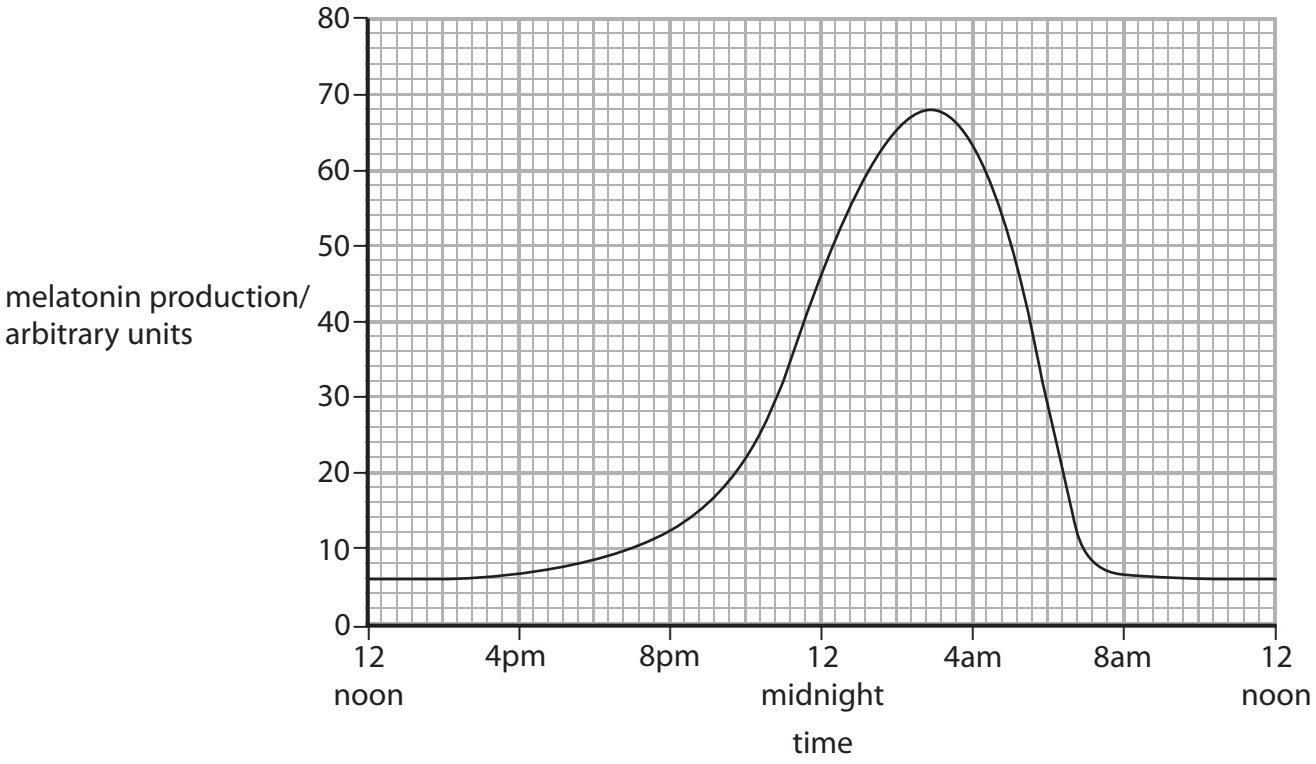
(1)

.....

(b) Melatonin is a hormone involved in the regulation of sleep cycles.

Light affects the production of melatonin.

The graph shows the level of melatonin in the blood of a person for 24 hours.



(i) Using information from the graph, describe the effect of light on melatonin levels in the blood.

(2)

.....

.....

.....

.....

(ii) Some biological activities in mammals follow a daily rhythm.

State the term used to describe this type of rhythm.

(1)

.....

(Total for Question 3 = 9 marks)

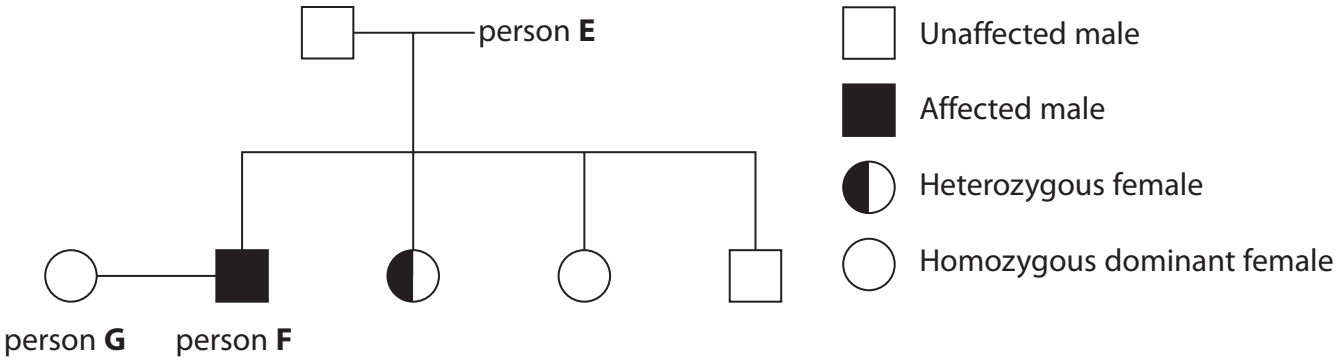
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Blood disorders

4 Haemophilia is a recessive sex-linked genetic disorder.

The letter **h** is used for the recessive allele and **H** for the dominant allele.

The diagram shows the inheritance of haemophilia in a family.



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

The genotype of person **E** is

(1)

☒ **A** X^hX^H

☒ **B** X^HX^H

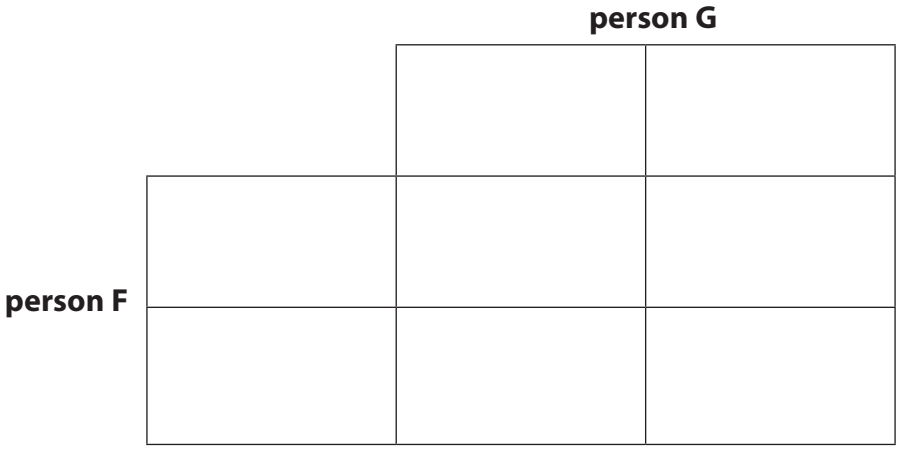
☒ **C** X^hY

☒ **D** X^HY

(ii) Calculate the probability of person **F** and person **G** having a child with haemophilia.

Use the Punnett square for your answer.

(3)



Probability of having a child with haemophilia .....

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(b) Blood clots can be detected using monoclonal antibodies.

(i) Describe how monoclonal antibodies are produced.

(4)

(ii) Describe how monoclonal antibodies can be used to detect blood clots.

(2)

(Total for Question 4 = 10 marks)

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Human evolution and migration

5 The history of human migration can be tracked by analysing mitochondrial DNA.

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

Mitochondrial DNA is inherited down the female line because the mitochondria are found in the

(1)

☒ **A** egg cytoplasm

☒ **B** egg nucleus

☒ **C** sperm cytoplasm

☒ **D** sperm nucleus

(b) Explain the effect of the Ice Age on human migration.

(3)

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*(c) Many fossils of early humans have been discovered in Africa, including Lucy from 3.2 million years ago.

Leakey found many early human fossils in Africa from 1.6 million years ago.

Describe how Leakey used the fossils and surrounding environment to reach the conclusion that his fossils were from a species more recent than Lucy.

(6)

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(d) Human evolution has been influenced by parental care.

Explain how parental care contributes to evolution.

(2)

(Total for Question 5 = 12 marks)

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DNA technology

6 Recombinant DNA technology is used to insert the insulin gene into bacteria.

The same technology is used to transfer a toxin gene from the bacterium *Bacillus thuringiensis* into *Agrobacterium tumefaciens.*

(a) Describe how the toxin gene from *Bacillus thuringiensis* is transferred to *Agrobacterium tumefaciens*.

(3)

(b) *Agrobacterium tumefaciens* can be used to transfer the toxin gene to the cells of crop plants.

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

In this process, *Agrobacterium tumefaciens* acts as

(1)

☒ **A** an enzyme

☒ **B** a hybridoma

☒ **C** an antigen

☒ **D** a vector

(c) Explain how *Agrobacterium tumefaciens* transfers the toxin gene to the crop plants.

(2)

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*(d) Cells containing the toxin gene produce a chemical that kills insects.

Explain the advantages and disadvantages of introducing the toxin gene into crop plants.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2016

Pearson Edexcel GCSE in Biology (5BI3H) Paper 01 Unit 3: Using Biology

Edexcel and BTEC Qualifications

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question number	Answer	Notes	Marks
1 (a) (i)	do not use land needed for food production/take up less land/grow independent of the climate/easier to control growth conditions (1)	accept grow quicker ignore grown all year round/grown in water ignore renewable/ carbon neutral	(1)

Question number	Answer	Notes	Marks
1 (a) (ii)	carbon dioxide	accept correct chemical formula (CO_2) reject CO_2	(1)

Question number	Answer	Notes	Marks
1 (a) (iii)	an explanation linking two of the following prevents {contamination with/entry of} other micro organisms (1) {reduces/no} competition (1) increases yield/more product (1) prevents contamination of product (1)	accept kills unwanted micro organisms	(2)

Question number	Answer	Notes	Marks
1 (a) (iv)	Any two of the following light (1) temperature (1) pH (1) minerals/named mineral/nutrients (1)	 ignore heat/warmth ignore food ignore oxygen/carbon dioxide/water	(2)

Question number	Answer	Notes	Marks
1 (b)	A description including two of the following renewable/sustainable (1) remove carbon dioxide from atmosphere during growth/only release carbon dioxide taken in during growth when burnt (1) release less sulfur dioxide when burned/less acid rain (1)	accept regrown quickly/won't run out accept carbon neutral ignore references to global warming, climate change and cost	(2)

(total for question 1 = 8 marks)

Question number	Answer	Notes	Marks
2 (a) (i)	P – Q / 170 – 80 = 90 (1) or 80/170 x 100 = 47/47.1% (1) and 53 / 52.9 / 52.94 (%)	two marks for correct answer	(2)

Question number	Answer	Notes	Marks
2 (a) (ii)	An description including two of the following selective re-absorption/reabsorbed into the blood (1) using energy (1) by active transport/against the concentration gradient (1) in convoluted tubule/at location Q (1)	accept diffuses into the blood accept from a low concentration to a high concentration	(2)

Question number	Answer	Notes	Marks
2 (a) (iii)	A explanation including the following increases (1) water is re-absorbed (1)	 accept water is absorbed into the blood	 (2)

Question number	Answer	Notes	Marks
2 (b) (i)	A ☒ Bowman's capsule		(1)

Question number	Answer	Notes	Marks
2 (b) (ii)	ADH/antidiuretic (hormone)	accept vasopressin accept phonetically correct misspellings	 (1)

Question number	Answer	Notes	Marks
2 (b) (iii)	D urethra		(1)

(total for question 2 = 9 marks)

Question number	Answer	Notes	Marks
3 (a) (i)	A menstruation		(1)

Question number	Answer	Notes	Marks
3 (a) (ii)	pregnancy/fertilisation	accept correct reference to hormone treatments such as contraception ignore maintains the lining of the uterus	(1)

Question number	Answer	Notes	Marks
3 (a) (iii)	An explanation including three of the following maintains/thickens uterus lining (1) inhibits FSH(1) inhibits LH (1) low levels trigger menstruation/high levels prevent menstruation (1)	accept builds up uterus lining ignore uterus wall accept low levels of progesterone allow release of FSH	(3)

Question number	Answer	Notes	Marks
3 (a) (iv)	LH/luteinising (hormone)	accept phonetically correct misspellings	(1)

Question number	Answer	Notes	Marks
3 (b) (i)	melatonin levels rise in the {dark/night} / melatonin levels low in the {light/day} (1) credit correct reference to data on time or melatonin production from the graph (1)		(2)

Question number	Answer	Notes	Marks
3 (b) (ii)	circadian (rhythm)	accept phonetically correct misspellings reject cyclic/cardiac/carcadian	(1)

(total for question 3 = 9 marks)

Question number	Answer	Notes	Marks
4 (a) (i)	A X_hX_H		(1)

Question number	Answer	Notes	Marks
4 (a) (ii)	correct gametes (1) correct offspring (1) 0%/ 0 in 4 (1)	accept ecf if person F and person G switched in the Punnett square for offspring	(3)

	XH	XH
Xh	XhXH	XhXH
Y	XHY	XHY

Question number	Answer	Notes	Marks
4 (b) (i)	A description including four of the following injection of antigen into {mouse/mammal}(1) {production/collection} of B lymphocytes (1) (B-lymphocyte) fused with {tumour/cancer/myeloma} cells (1) hybridoma (1) (hybridoma) can divide and produce antibodies (1)	accept protein from blood clot for antigen accept multiply or reproduce for divide when linked to the hybridoma	(4)

Question number	Answer	Notes	Marks
4 (b) (ii)	A description including two of the following attach radioisotope to monoclonal antibody (1) inject into the blood stream (1) antibodies {binds/attaches} to the clot (1) antibody {location/accumulation} determined using a {scanner/detector/computer} (1)	ignore inject into body accept binds to platelet/fibrin	(2)

(total for question 4 = 10 marks)

Question number	Answer	Notes	Marks
5 (a)	A egg cytoplasm		(1)

Question number	Answer	Notes	Marks
5 (b)	An explanation linking three of the following {increased/forced} migration/migration was easier/migrate further (1) reduced {sea/water} levels (1) water locked up in ice/seas frozen (1) land bridges/shorter sea crossings (1)	accept migration to find warmth/food accept idea of walking across ice	(3)

Question Number		Indicative Content	Mark
QWC	*5c	A description to include some of the following points Fossil evidence Structural features of fossil Facial features Larger cranial capacity More upright Longer legs/shorter arms Changes in joints Taller than Lucy Environment Evidence of stone tools Location in the rock layer Dating from environment Leakey's fossils are found higher in the rock layer Leakey's fossils found with stone tools/more sophisticated stone tools Radiometric dating of rocks surrounding fossil	(6)
Level	0	No rewardable content	
1	1 - 2	A limited description including at least one piece of evidence from the fossil evidence OR the environment the answer communicates ideas using simple language and uses limited scientific terminology spelling, punctuation and grammar are used with limited accuracy	

2	3 - 4	A simple description including at least two pieces of evidence from the fossil structure with comparative statements to Lucy OR one piece of evidence from the fossil structure and one from the environment/dating OR two pieces of evidence from dating from the environment the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately spelling, punctuation and grammar are used with some accuracy
3	5 - 6	A detailed description of the pieces of evidence including at least two comparative statements to Lucy from the fossil structure AND at least two pieces of evidence about dating from the environment. the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately spelling, punctuation and grammar are used with few errors

Question number	Answer	Notes	Marks
5 (d)	An explanation linking the following better parental care leads to increased survival of offspring (1) (the offspring are more likely to reproduce) and pass on the beneficial traits/genes/skills (1)		(2)

(total for question 5 = 12 marks)

Question number	Answer	Notes	Marks
6 (a)	A description linking three of the following (Agrobacterium/bacterial) plasmid cut using restriction enzymes (1) gene isolated (from Bacillus thuringiensis) using restriction enzymes (1) (restriction enzymes) leave sticky ends/complementary sticky ends (1) gene inserted into plasmid using ligase enzymes (1) plasmid placed into Agrobacterium tumefaciens (1)	accept circular DNA accept ICP for gene accept circular DNA accept circular DNA	(3)

Question number	Answer	Notes	Marks
6 (b)	D a vector		(1)

Question number	Answer	Notes	Marks
6 (c)	An explanation linking two of the following (Agrobacterium tumefaciens) infects the plant (cell)/is a vector (1) transfer of {plasmid/gene/DNA} to plant cell/incorporation of gene into plant DNA (1) growth of a {crown gall/tumour} (1)	accept leaf discs for plant cells	(2)

Question Number		Indicative Content	Mark
QWC	*6d	An explanation to include some of the following points: Advantages kills the pests that feed on the crop plants less crop plants eaten by pests reduced use of pesticides/insecticides/chemicals naturally occurring/less bioaccumulation specific/does not affect other species increased yield/reduced land use reduced pesticide levels in crops Disadvantages reduces biodiversity/impacts on food web for the ecosystem risk of cross pollination transfer to other plant species public concern/potential health risks to humans insects develop resistance unknown effects on other insects/possible reduced pollination reliance on seed companies/increased cost	(6)
Level	0	No rewardable content	
1	1 - 2	A limited explanation including at least one advantage OR one disadvantage	

		the answer communicates ideas using simple language and uses limited scientific terminology spelling, punctuation and grammar are used with limited accuracy
2	3 - 4	A simple explanation including at least one advantage AND one disadvantage OR a detailed explanation of the advantages OR disadvantages the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately spelling, punctuation and grammar are used with some accuracy
3	5 - 6	A detailed explanation of at least two advantages AND two disadvantages including the reduced use of pesticides/insecticides and impact on crop yield and possible risk of insects developing resistance the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately spelling, punctuation and grammar are used with few errors

(total for question 6 = 12 marks)

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Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Biology

Unit B3: Using Biology

Higher Tier

Monday 15 June 2015 – 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.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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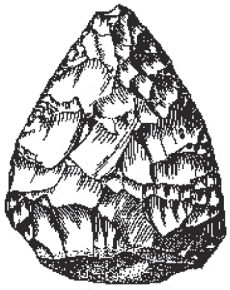
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Answer ALL questions

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

Human evolution

1 The diagram shows four Stone Age tools discovered at different archaeological sites in Europe.

			
handaxe	arrow head	cutting stone	hammer stone

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

The Stone Age tool made most recently is the

(1)

- ☒ **A** handaxe
- ☒ **B** arrow head
- ☒ **C** cutting stone
- ☒ **D** hammer stone

(ii) Suggest how these tools may have helped early humans to survive.

(2)

.....

.....

.....

.....

.....

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(b) Mitochondrial DNA can be used as evidence for human evolution.

Explain why mitochondrial DNA is used rather than nuclear DNA.

(2)

(c) Describe how fossil evidence can be used to show that humans have evolved.

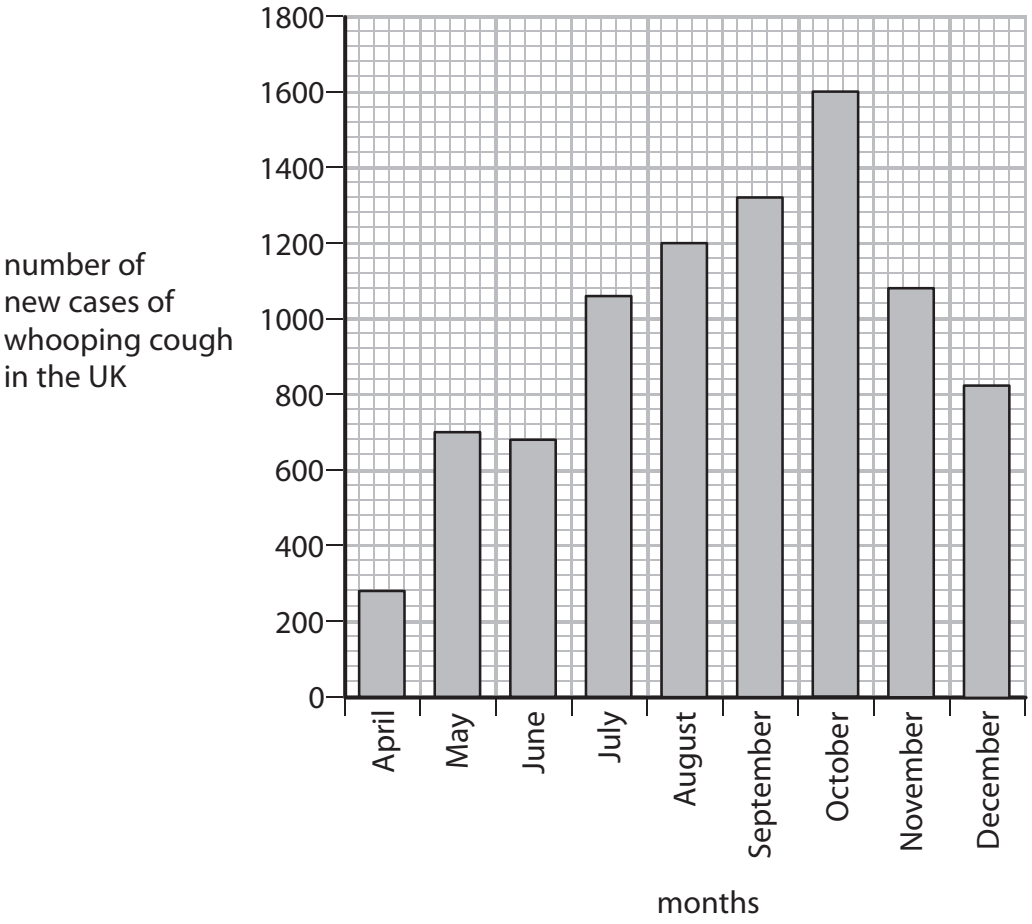
(2)

(Total for Question 1 = 7 marks)

Bacterial infection

2 In 2012 there was an outbreak of whooping cough in the UK.

The graph shows the number of new cases of whooping cough in the UK from April to December 2012.



(a) (i) Describe the trend shown in the graph from April to December.

(1)

.....

.....

(ii) In September 2011 there were 168 cases of whooping cough in the UK.

Calculate the difference in the number of cases of whooping cough in September 2011 and September 2012.

(2)

..... cases

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(b) Whooping cough is caused by the bacterium *Bordetella pertussis*, which grows rapidly in the human body.

State the term used to describe the rapid growth of a bacterial population.

(1)

(c) Children in the UK can be immunised against whooping cough.

Suggest why outbreaks of whooping cough still occur in the UK.

(2)

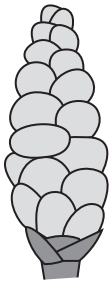
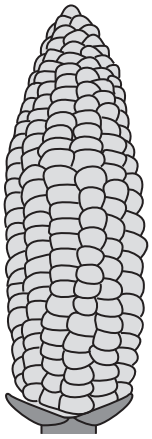
(d) Describe the response of the human body to immunisation.

(3)

(Total for Question 2 = 9 marks)

Food production

3 The diagram shows the development of maize cobs over the last 1000 years of cultivation.

maize cobs				
mean mass of cob /g	15	45	70	90
date	1000 years ago →			Present

(a) Describe how scientists can use plant breeding programmes to produce maize plants with larger cobs.

(3)

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(b) There has been an increase in the use of pesticides during the last 1000 years.

Explain how the use of pesticides may benefit maize production.

(2)

(c) Maize plants can be used in the production of biofuel.

Discuss the advantages and disadvantages of the use of biofuel.

(4)

(d) Plants grown for biofuel could be genetically modified.

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

The microorganism used as a vector to produce transgenic plants is

(1)

☒ **A** *Agrobacterium tumefaciens*

☒ **B** *Bacillus thuringiensis*

☒ **C** *Fusarium venenatum*

☒ **D** *Saccharomyces cerevisiae*

(Total for Question 3 = 10 marks)

Medical technology

4 Infertility can be treated by increasing the chance of ovulation occurring.

Ovulation is controlled by hormones.

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

The hormone that stimulates the maturation of follicles in the ovary is

(1)

- ☒ **A** FSH
- ☒ **B** LH
- ☒ **C** oestrogen
- ☒ **D** progesterone

(ii) Infertility treatments, including the use of hormones, can stimulate ovulation.

Explain **one** disadvantage of treating infertility by using hormones to stimulate ovulation.

(2)

.....

.....

.....

.....

.....

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

Ovulation during pregnancy is prevented by high levels of

(1)

- ☒ **A** FSH
- ☒ **B** LH
- ☒ **C** insulin
- ☒ **D** progesterone

(b) Monoclonal antibody technology is used in pregnancy tests and in the treatment of cancer.

(i) Explain how monoclonal antibodies are used to test for pregnancy.

(3)

(ii) The use of monoclonal antibodies to treat cancer has advantages over the use of traditional chemotherapy and radiotherapy.

Explain the benefits of using monoclonal antibodies to treat cancer.

(2)

(iii) Name the type of cell that produces the monoclonal antibodies used to treat cancer.

(1)

(Total for Question 4 = 10 marks)

5 People with diabetes insipidus are unable to produce enough of the hormone ADH.

In a medical study, the ADH levels in the blood of eight people were measured.

Four of the people, A, B, C and D, do not have diabetes insipidus.

The other four people, E, F, G and H, have diabetes insipidus.

The results are shown in the tables.

people without diabetes insipidus	ADH level in blood / µg per dm^3
A	5.2
B	2.8
C	4.9
D	3.5
Mean ADH level:	

people with diabetes insipidus	ADH level in blood / µg per dm^3
E	0.1
F	0.2
G	0.1
H	0.0
Mean ADH level:	0.1

(a) (i) Calculate the mean ADH level in the people without diabetes insipidus.

(2)

..... µg per dm^3

(ii) Suggest why there is a wide range of ADH levels in the people without diabetes insipidus.

(2)

.....

.....

.....

.....

.....

.....

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

ADH is a hormone released into the blood by the

(1)

- ☒ **A** corpus luteum
- ☒ **B** collecting duct
- ☒ **C** pituitary gland
- ☒ **D** glomerulus

(iv) Suggest a symptom of diabetes insipidus.

(1)

*(b) Explain the role of ADH in regulating the water content of the blood.

(6)

(Total for Question 5 = 12 marks)

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6 A diet that is high in fat can lead to an increase in the total cholesterol levels in the blood.

The table shows the total cholesterol levels in the blood of a man, over a 10-year period.

time	total cholesterol level in blood / mmol per dm^3
10 years ago	4.8
5 years ago	5.1
present day	6.0

(a) (i) Calculate the percentage increase in total cholesterol level in the blood over this 10-year period.

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

(1)

☒ **A** 2.0%

☒ **B** 2.5%

☒ **C** 20.0%

☒ **D** 25.0%

(ii) The government recommends that the total cholesterol level in the blood for adults should be 5 mmol per dm^3.

Explain why this man has been advised to eat mycoprotein rather than meat.

(2)

.....

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.....

(b) Describe how mycoprotein is produced.

(3)

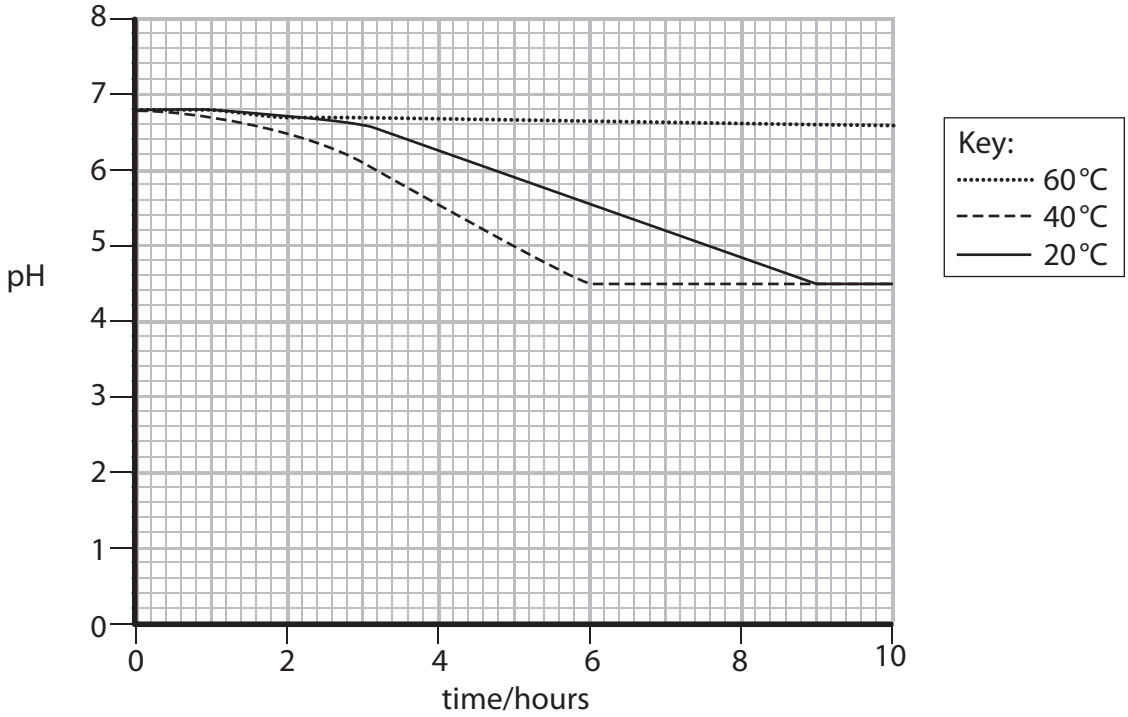
*(c) Yogurt can be produced by adding a starter culture of microorganisms to milk.

The starter culture was added to milk kept at 20 °C.

The pH was recorded over 10 hours.

This was repeated with milk kept at 40 °C and 60 °C.

The graph shows the results.



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Using the information in the graph, explain how temperature affects the fermentation process during yogurt production.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2015

Pearson Edexcel GCSE in Biology (5BI3H/01) Unit 3: Using Biology

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
-

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	**B** ☒ arrow head		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	**A suggestion including two of the following** hunting/fighting/defence (1) {preparing/ cooking/foraging for} food (1) making clothes (1) construction of {shelters/new tools/sharpening tools} (1) making fire (1)	 accept weapons accept skinning animals for food/scrapping bones accept skinning for clothes accept chopping wood	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)	**An explanation linking two of the following** **higher** abundance (1) **more** stable over time/**less** susceptible to decay (1) high mutation rate (1) inheritance down female line (1)	 accept **easier** to extract accept idea of maternal inheritance accept no recombination (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)	**A description including two of the following** show **changes** in body structure (1) **changes** in stone tools (1) a specific example eg Ardi/Lucy/*Homo erectus* (1)	 accept development of named structural changes	**(2)**

Total for Question 1 = 7 marks

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	an increase in cases until **October** and then a decrease (in the number of cases) (1)	accept an increase in cases till **November** when it decreases	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	1320 (1) 1320 – 168 = 1152	**2 marks for correct answer**	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)	exponential (growth)	log / logarithmic (growth)	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)	**A suggestion including two of the following** not everyone has been immunised (1) immigration introduces people who are not immunised (1) immunisation not fully effective (1) immunity can decrease with age (1)	 accept no herd immunity accept bacteria mutates (making immunisation ineffective) accept immunity requires boosters/loss of memory lymphocytes	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(d)	**A description including the following** (immunisation) introduces an antigen/(immunisation) causes an immune response (1) (B) lymphocytes (1) production of antibodies (1) (the production of) <u>memory lymphocytes</u> (1)	 accept immune system recognises an antigen (in the immunisation) ignore white blood cells	**(3)**

Total for Question 2 = 9 marks

Question Number	Answer	Acceptable answers	Mark
3(a)	**A description to include three of the following** selection of individuals with {favourable characteristics/largest cobs}/collect seeds from plants with large cobs (1) cross breeding (of selected individuals)/plant seeds together (from maize with large cobs) (1) selection of offspring (1) repeat process over time (1)	accept selective breeding	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(b)	**An explanation including two of the following** reduce number of pests (1) reduced damage to crop/maize (1) increased yield (1) OR kills weeds (1) reduces competition for {light/space/named resource}(1) increased yield (1)	accept kill pests/insects/named pest/deters animals **reject** predators	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)	**A discussion to include a maximum of two from Advantages:** removes CO_2 when growing (1) less use of {fossil fuels/named fuel} (1) reduced SO_2 emissions (1) renewable / can be regrown quickly /sustainable (1) **A discussion to include a maximum of two from Disadvantages:** reduced food production (1) takes up land (1) reduced biodiversity (1) crop growth is weather dependent (1)	 accept carbon neutral **reject** CO^2 **reject** SO^2 accept deforestation ignore references to cost and energy content	**(4)**

Question Number	Answer	Acceptable answers	Mark
3(d)	**A** ☒ *Agrobacterium tumefaciens*		**(1)**

Total for Question 3 = 10 marks

Question Number	Answer	Acceptable answers	Mark
4 (a)(i)	**A** ☒ FSH		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	**An explanation linking two of the following** more than one egg {released / fertilised }(1) multiple birth / pregnancy (1) increased risk of complications for mother/babies (1) OR women affected by side effects (1) treatment has to be stopped reducing chance of pregnancy (1)	accept headaches, mood swings, nausea, abdominal pain, diarrhoea, weight gain ignore references to cost	**(2)**

Question Number	Answer	Acceptable answers	Mark
4 (a)(iii)	**D** ☒ progesterone		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	**An explanation linking three from the following** urine sample (1) coloured bead attached to a (mobile monoclonal) antibody (1) antibody {specific to/detects/binds to} { hormone/hCG} (1) immobile antibody at test strip (1) colour accumulates in positive test window (1)	accept named female sex hormones	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	**An explanation linking two of the following** chemotherapy/radiotherapy drug attached to the monoclonal antibody (1) less use of the drug (1) only binds to cancer cells/doesn't target normal cells (1) reduces side effects/named side effects (1)	monoclonal antibody binds to {**tumour markers/cancer antigens**} (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(iii)	hybridoma (cell)		**(1)**

Total for Question 4 = 10 marks

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	(5.2 + 2.8 + 4.9 + 3.5 =) 16.4 (1) (16.4/4 =) 4.1	two marks for correct answer	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	**A suggestion including two of the following** variation in human population/different body sizes (1) hydration level (1) salt intake (1) drug influence (1)	 accept genetic variation accept fluid / food intake / level of exercise accept levels vary depending on the time of day (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(iii)	**C** ☒ pituitary gland		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(iv)	dehydration / thirst / increased volume of urine	accept dilute urine/frequent urination/tiredness/dizzy/headache	**(1)**

Question Number		Indicative Content	Mark
QWC	***5(b)**	An explanation to include some of the following points • negative feedback Hydration • increased water/decreased salt in blood • detected by hypothalamus • acts on the pituitary gland • decreased release of ADH • decreased permeability of collecting duct/renal tubules/nephron • less re-absorption of water • Increased volume of urine Dehydration • decreased water/increase salt in blood • detected by hypothalamus • acts on the pituitary gland • increased release of ADH • increased permeability of collecting duct/renal tubules/nephron • more re-absorption of water • decreased volume of urine	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation of increase in ADH **OR** decrease in ADH **OR** the role of the pituitary gland, hypothalamus or negative feedback in the release of ADH • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple explanation of both ADH increase **and** decrease **OR** a detailed explanation of either an increase or decrease • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation of both ADH increase **and** decrease including mention of permeability of the renal tubules and role of the hypothalamus or pituitary gland • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total for Question 5 = 12 marks

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	**D** ☒ 25.0 %		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	An explanation linking the following to lower cholesterol levels/the man's cholesterol level exceeds government recommended levels (1) (mycoprotein) lower in {fat / saturated fat} / mycoprotein contains {no/less} cholesterol (1) which reduces chances of heart attack / stroke / named health condition (1)	 accept the man's cholesterol level is 6 (mmol per dm^3) accept atherosclerosis/stroke/angina ignore heart disease/heart problems	**(2)**

Question Number	A description	Acceptable answers	Mark
6(b)	A description including three of the following use of fermenter (1) *Fusarium* (fungus) (1) supplied with {sugar source/ammonia/oxygen} (1) maintain optimal conditions / aseptic conditions/without stirring (1) (after growth) processed to produce mycoprotein (1)	 ignore air ignore nutrients accept named conditions e.g. pH, temperature ignore references to paddles stirring	**(3)**

Question Number		Indicative Content	Mark
QWC	***6(c)**	An explanation including some of the following points Data trends • pH of milk is 6.8 • pH reduces to pH 4.5 in 6 hours at 40°C • pH reduces to pH 4.5 in 9 hours at 20°C • pH not significantly reduces at 60°C Interpretation • fermentation faster at the optimum temperature • optimum temperature for bacteria growth at 40°C • enzymes more active at optimum temperature • no fermentation/bacteria killed/enzymes denature at high temperatures Yogurt production • lactose in the milk • converted into lactic acid • by bacteria/named bacteria • reduces pH • thickens/clots/coagulates the milk	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation of the data **OR** the interpretation of the data **OR** the production of yogurt e.g. At 60°C the pH does not decrease or bacteria causes the milk to thicken • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple explanation of the data trends linked to the interpretation **OR** a detailed description of the production of yogurt • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation of the data/interpretation linked to the production of yogurt including the production of lactic acid causing the decrease in pH • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total for Question 6 = 12 marks

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Surname	Other names

Pearson Edexcel GCSE

Centre Number | Candidate Number

Biology

Unit B3: Using Biology

Higher Tier

Monday 16 June 2014 – 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.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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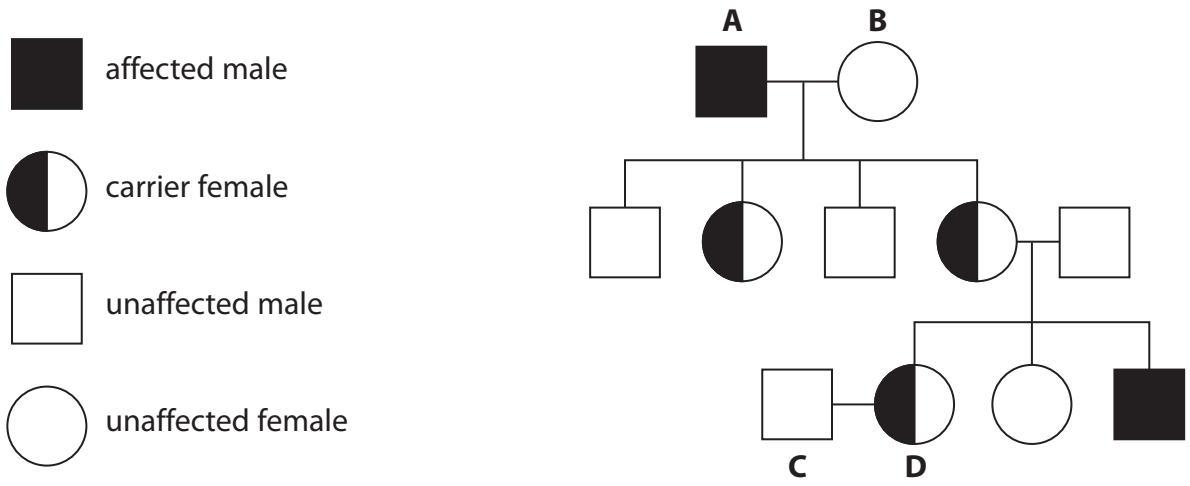
Answer ALL questions

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

Sex-linked genetic disorders

1 Haemophilia is a recessive sex-linked disorder.

This family pedigree shows the inheritance of haemophilia.



(a) (i) State the sex chromosomes of person **B**.

(1)

.....

(ii) Explain why the male offspring from **A** and **B** do not have haemophilia.

(2)

.....

.....

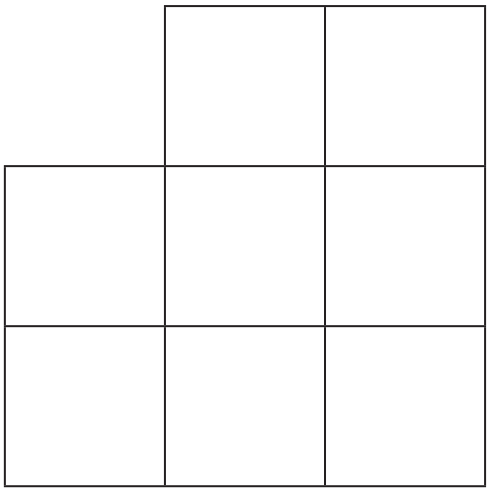
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(iii) Using the Punnett square, calculate the probability that individuals **C** and **D** could have a child with haemophilia.

(3)



(b) Haemophilia can be treated using a blood clotting factor produced in a fermenter.

The conditions inside a fermenter have to be carefully controlled.

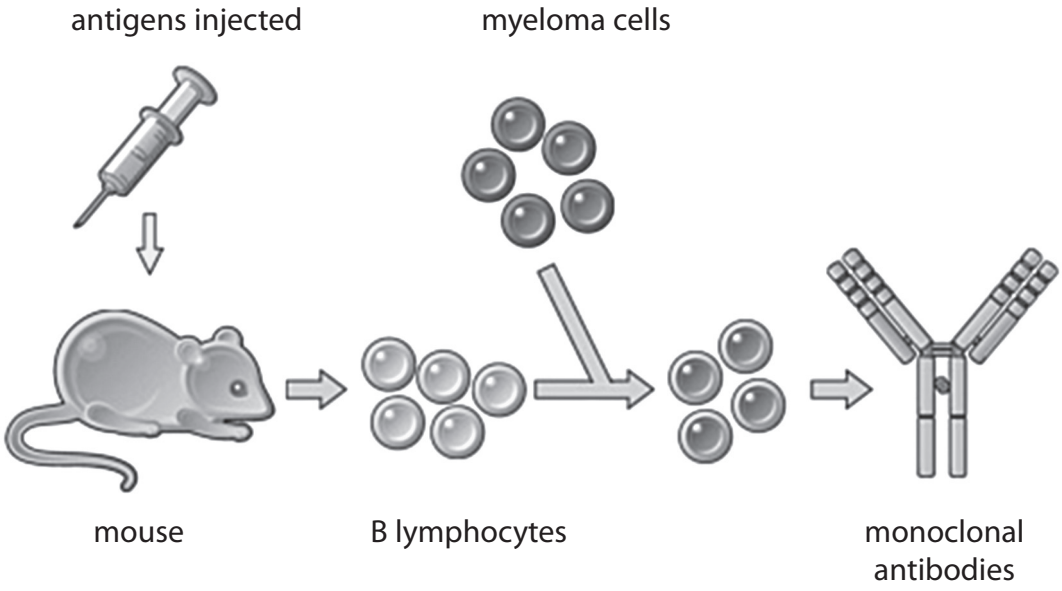
Explain why **one** named condition must be controlled in a fermenter.

(2)

(Total for Question 1 = 8 marks)

Monoclonal antibodies and the immune response

2 The diagram shows some stages in the production of monoclonal antibodies.



(a) (i) Complete the sentence using words from the box.

(2)

memory lymphocytes	exponential	hybridomas
immune	aseptic	myeloma cells

Injecting antigens into the mouse produces an .....

response resulting in the production of antibodies and .

..... .

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

The cells produced when B lymphocytes and myeloma cells combine are

(1)

☒ **A** antibodies

☒ **B** hybridomas

☒ **C** memory lymphocytes

☒ **D** platelets

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(iii) Describe **two** ways in which monoclonal antibodies are used in medical diagnosis.

(2)

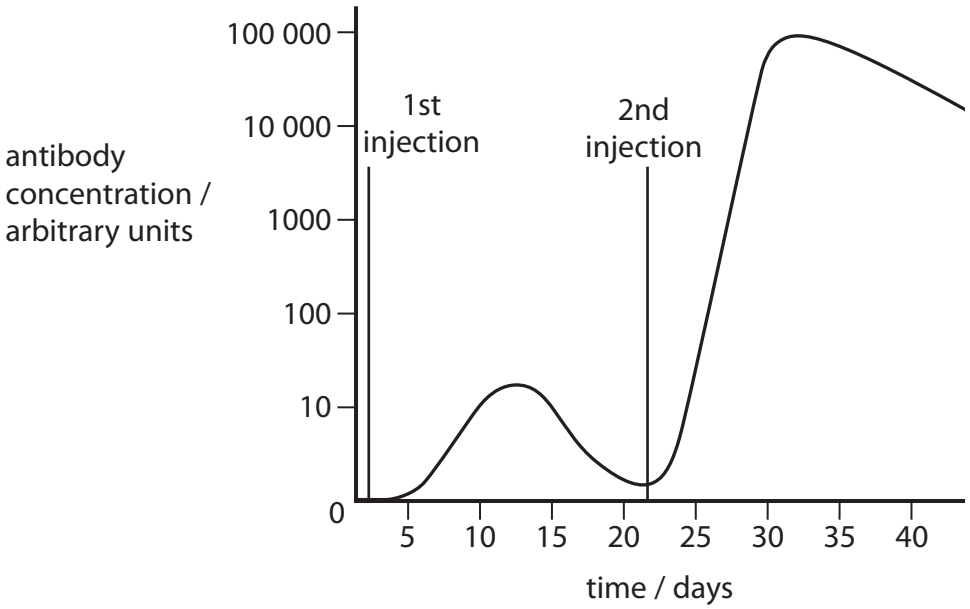
1 .....

.....

2 .....

.....

(b) The graph shows the antibody concentration in a mouse after the first and second injection of the same antigens.



(i) Compare the antibody response after the first injection with the antibody response after the second injection.

(2)

(ii) Suggest how this secondary response to antigens benefits the mouse.

(1)

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

Injecting patients with antigens forms the basis of vaccination.

This was first developed by

(1)

☒ **A** Diane Fossey

☒ **B** Edward Jenner

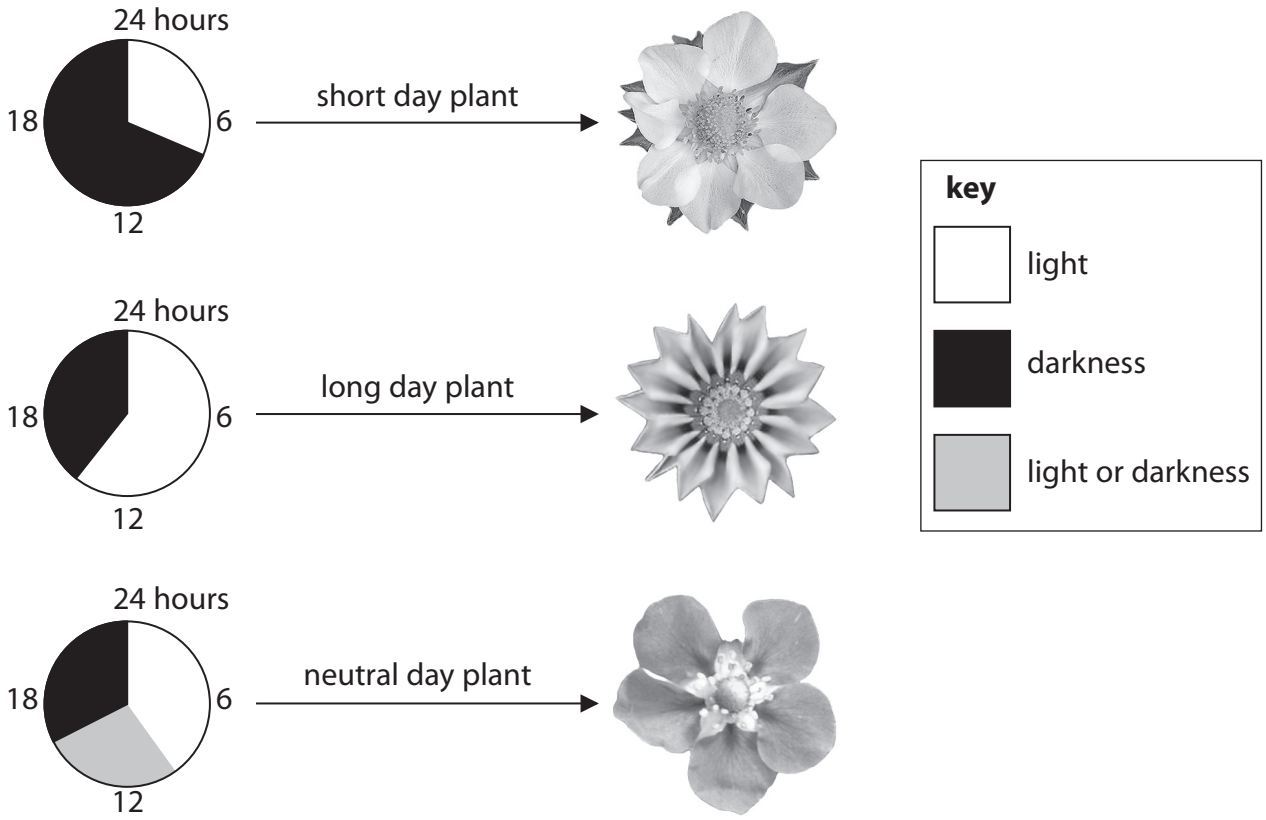
☒ **C** Louis Pasteur

☒ **D** Mary Leakey

(Total for Question 2 = 9 marks)

Plants and animals

3 The diagram shows the number of hours of darkness and light needed for flowering in three different plant groups.



(a) (i) State the number of hours of darkness needed for a long day plant to flower.

(1)

..... hours

(ii) A gardener has 500 short day plants.

85% of these plants flowered in March.

Calculate the number of plants flowering in March.

(2)

..... plants

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(iii) Suggest a benefit to a plant of being day neutral.

(1)

.....

.....

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

Plants flowering in response to the number of hours of darkness and light is an example of

(1)

☒ **A** circadian rhythms

☒ **B** germination

☒ **C** photoperiodism

☒ **D** phototropism

(b) (i) The leaves of some species of bamboo plants contain the poison cyanide.

Suggest how these bamboo plants benefit from having poisonous leaves.

(1)

.....

.....

(ii) The photograph shows a greater bamboo lemur.



The greater bamboo lemur is adapted to tolerate cyanide.

This means that it can eat bamboo leaves containing cyanide.

Explain how the co-evolution of bamboo plants and the greater bamboo lemur could have occurred.

(2)

.....

.....

.....

.....

.....

.....

(c) Two ethologists, Bergey and Patel, studied the call types used in communication between greater bamboo lemurs.

The table is a summary of their findings.

call types	behaviour
agitated calls	aggression
bahh calls	submission
breath out calls	aggression
contact calls	submission and aggression
purr calls	friendship and resting
squeal calls	submission
woof calls	aggression

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

The behaviour associated with most call types is

(1)

☒ **A** aggression

☒ **B** friendship

☒ **C** resting

☒ **D** submission

(ii) Explain the benefit of communicating using sound rather than facial expressions.

(2)

.....

.....

.....

.....

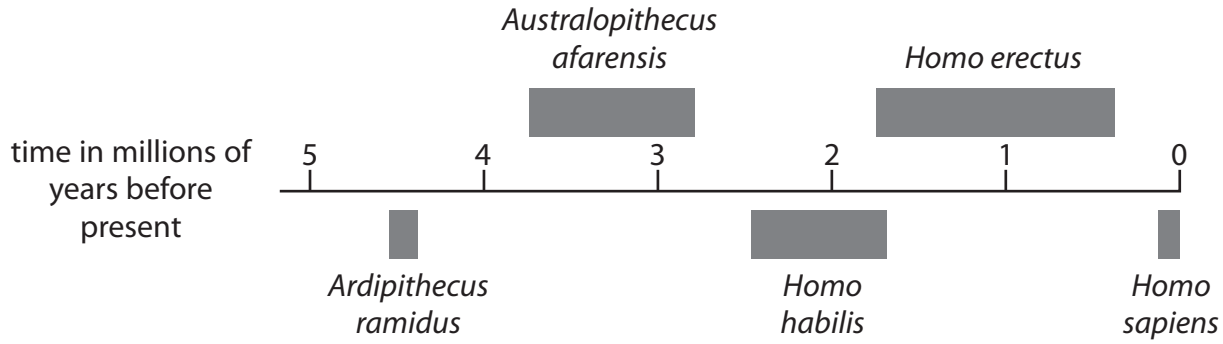
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(Total for Question 3 = 11 marks)

Human evolution and behaviour

4 The timeline shows when *Homo sapiens* and some of their ancestors are thought to have inhabited the Earth.



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

The species which is thought to have inhabited the Earth for the longest period of time is

(1)

☒ **A** *Australopithecus afarensis*

☒ **B** *Homo erectus*

☒ **C** *Homo habilis*

☒ **D** *Homo sapiens*

(ii) Estimate the number of years that *Homo habilis* inhabited the Earth.

(1)

.....

(b) Scientists in Africa discovered part of a fossilised skull.

The skull was identified as belonging to the species *Homo erectus*.

Describe the methods scientists may have used to identify the skull as belonging to the species *Homo erectus*.

(2)

.....

.....

.....

.....

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(c) *Homo sapiens* evolved in Africa and then migrated to other areas of the world.

Mitochondrial DNA analysis can be used to map human migration.

Compare the benefits of using mitochondrial DNA rather than nuclear DNA to map human migration.

(3)

(d) One group of *Homo sapiens* migrated to an environment where there was a large waterfall.

At first, the noise of the waterfall kept them awake at night but they got used to the noise over time.

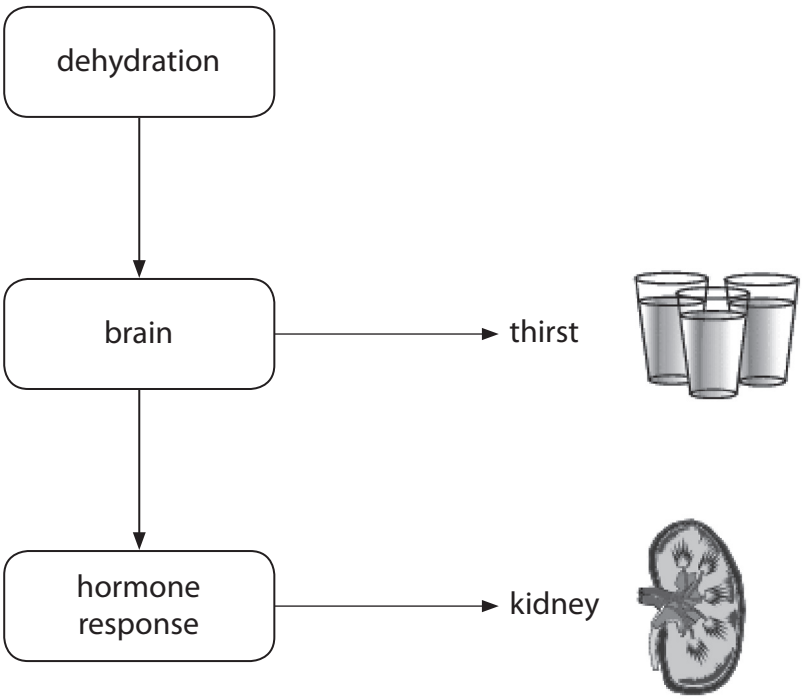
Explain this behavioural response.

(2)

(Total for Question 4 = 9 marks)

Hormonal control

5 The diagram shows the body's response to dehydration.



(a) Use the diagram to help explain the body's hormonal response to dehydration.

(4)

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(b) The menstrual cycle is also controlled by hormones including progesterone.

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

Progesterone is produced by the

(1)

☒ **A** corpus luteum

☒ **B** glomerulus

☒ **C** hypothalamus

☒ **D** pituitary gland

(ii) Describe the effect of high levels of progesterone on the uterus lining during pregnancy.

(1)

.....

.....

*(b) (iii) Explain how the menstrual cycle is controlled by hormones and negative feedback.

(6)

(Total for Question 5 = 12 marks)

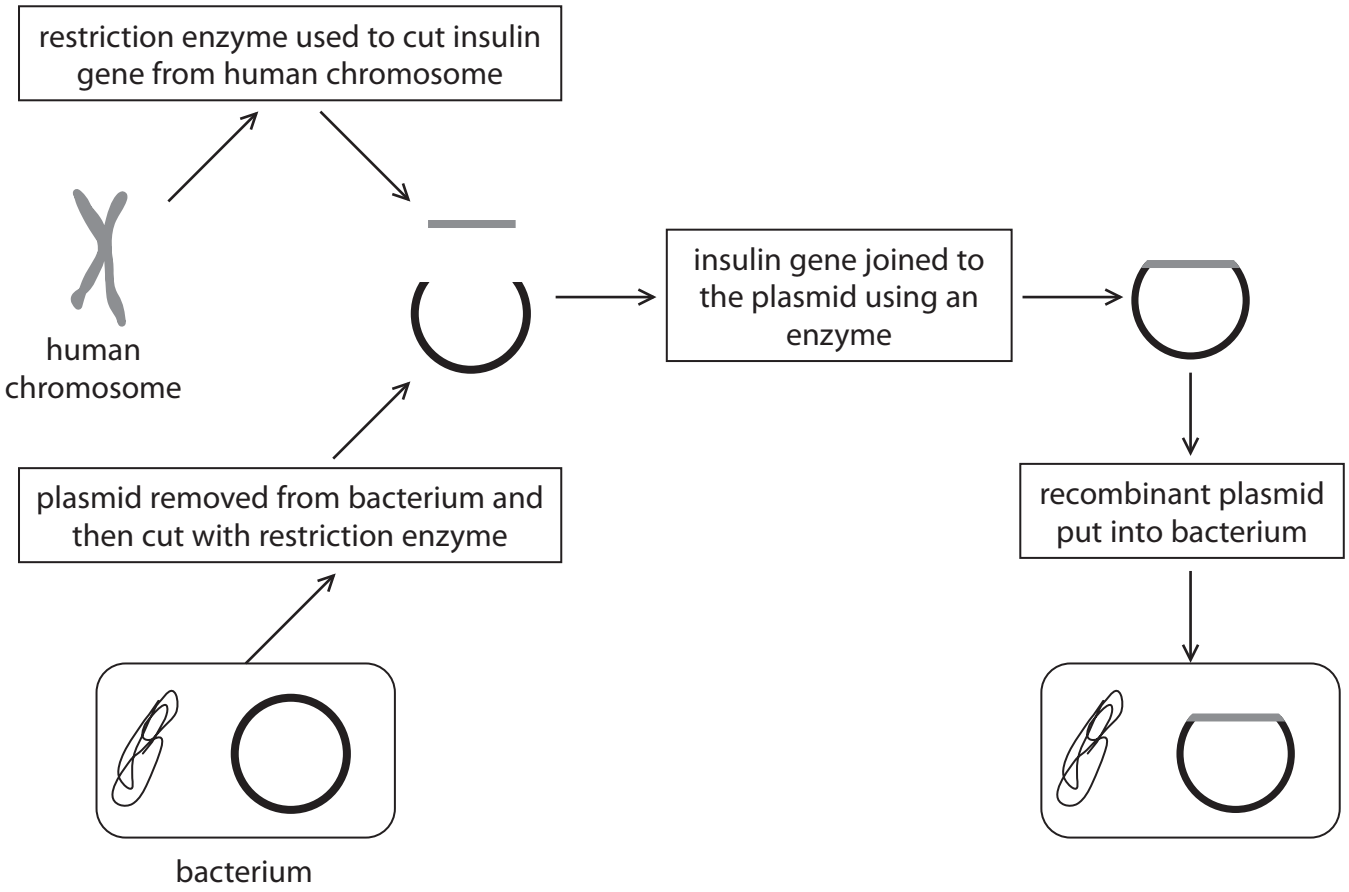
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Question 6 is on the next page

Enzyme technology

6 The diagram shows how the human insulin gene can be used to genetically modify bacteria.



(a) (i) Name the enzyme used to join the insulin gene to the plasmid.

(1)

.....

(ii) Suggest why the same restriction enzyme was used to cut the human chromosome and the plasmid.

(2)

.....

.....

.....

.....

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*(b) Enzyme technology can be used in the production of foods including sweets, vegetarian cheese and lactose-free milk.

Describe how enzyme technology can be used to produce these food products.

(6)

Question 6 continues on the next page

(c) Washing powders can be biological or non-biological.

Describe how biological washing powders can make clothes cleaner than non-biological washing powders.

(2)

.....

.....

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(Total for Question 6 = 11 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2014

Pearson Edexcel GCSE in Biology (5BI3H) Paper 01

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General Marking Guidance

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-

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

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- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	XX	ignore any superscript or subscript letters/symbols reject XY	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	An explanation linking two of the following they did not inherit the (haemophilia) allele (1) (allele is) located on X chromosome (1) males receive X chromosome from their mother/Y chromosome from father (1) B is homozygous dominant/ neither X chromosome from B has the allele for haemophilia (1)	ignore gene throughout accept have the dominant/normal allele accept disorder is located on the X chromosome ignore mother is unaffected accept mother neither affected **nor** a carrier accept mother for B and father for A	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(a)(iii)	<table><tr><td></td><td>X^H</td><td>Y</td></tr><tr><td>X^H</td><td>X^HX^H</td><td>X^HY</td></tr><tr><td>X^h</td><td>X^HX^h</td><td>X^hY</td></tr></table> a Punnett square showing the gametes of individuals C and D (1) a Punnett square showing the genotypes of the offspring (1) 25% / 0.25 / 1 in 4 probability of a child having haemophilia (1)	<table><tr><td></td><td>X^H</td><td>X^h</td></tr><tr><td>X^H</td><td>X^HX^H</td><td>X^HX^h</td></tr><tr><td>Y</td><td>X^HY</td><td>X^hY</td></tr></table> reject if allele shown on Y chromosome 50% of males have haemophilia Punnett square must be interpreted correctly	**(3)**

Question Number	Answer	Acceptable answers	Mark
1(b)	An explanation linking the following aseptic conditions (1) prevent growth of **unwanted** organisms/prevent contamination (1) OR temperature /pH (1) provide optimal conditions for growth /prevent enzymes denaturing (1) OR nutrient levels (1) provide optimal conditions for growth (1) OR aeration/oxygen (1) for <u>aerobic</u> respiration/ provide optimal conditions for growth / prevent <u>anaerobic</u> respiration (1)	ignore sterile provide optimal conditions for enzymes/prevent micro-organisms being killed	**(2)**

(Total for question 1 = 8 marks)

Question Number	Answer	Acceptable answers	Mark
2(a)(i)1	immune (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(i)2	memory lymphocytes (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	**B** hybridomas		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(iii)	**Two** of the following: pregnancy testing (1) locating the position of blood clots (1) locating the position of cancers (1)	 accept detecting blood clots accept detecting cancer cells	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	A comparison including two from: first response • delay in production of antibodies (1) • less antibodies produced (1) • production of antibodies slower (1)	or a second response • no delay in production of antibodies (1) • more antibodies produced (1) • production of antibodies faster (1) accept comparisons of data ignore references to decrease in antibody number	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	faster recovery / {no/less} symptoms of infection / increased chance of survival / kills pathogen faster(1)	accept more <u>memory</u> lymphocytes produced/ immune / fights infection faster	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(iii)	**B** Edward Jenner		**(1)**

(Total for question 2 = 9 marks)

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	8-10 (hours)	accept any value between 8 and 10	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	(85/100) x 500 (1) Or (500/100) x 85 (1) 425 (plants)	award two marks for correct bald answer	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)(iii)	plant can flower all year round/flowering not limited to one period of the year/plant can flower for longer/flower at any time.	ignore references to growing accept pollination for flowering	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(iv)	**C** photoperiodism		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	less likely to be eaten (by animals / herbivores)	accept kills pests/reduces damage done by pests reject predators	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	An explanation linking **two** of the following: the bamboo **mutated** to produce cyanide (1) or bamboo plants that produced cyanide survived to reproduce/ increase in numbers/increase in size (1) **and** **mutation** in greater bamboo lemur allowed them to tolerate cyanide (1) or greater bamboo lemurs get more food so survive to breed/reproduce (more) (1)	accept some bamboo plants have the {**gene / allele}** to produce cyanide ignore bamboo plants not eaten accept lemurs have {**gene / allele**} to tolerate cyanide ignore {adapted to tolerate/resistant to} cyanide accept lemurs have less **competition** for food	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	**A** aggression		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	An explanation linking two of the following: sounds can be heard over a long distance /heard in the dark (1) do not need to have visual contact/allows communication with more animals (1) or more different types of sound (1) more {emotions/ behaviour/ information} can be conveyed (1)	accept quicker communication method accept doesn't require good vision	**(2)**

(Total for question 3 = 11 marks)

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	**B** *Homo erectus*		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	any value between 0.7-0.9 million (years)	any value between 700 000-900 000 (years)	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)	A description including two of the following structural features/shape of fossil (1) (age of the fossil from) location in rock layers (1) structure of stone tools (1)	 accept comparison to other fossils radioactive dating (of rocks) ignore references to carbon dating ignore references to DNA analysis ignore brain size	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)	A comparison including three of the following more abundant than nuclear DNA (1) higher mutation rates (1) less likely to degrade (1)	 accept {large supply/lots} of mitochondrial DNA only inherited down the female line/no crossing over/recombination (1)	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(d)	An explanation linking the following: habituation / learned response (1) stop responding to {neutral signal /harmless signal} (1)	accept become used to a harmless stimulus ignore references to getting used to the sound of the waterfall	**(2)**

(Total for question 4 = 9 marks)

Question Number	Answer	Acceptable answers	Mark
5(a)	An explanation linking **four** of the following points: • (dehydration detected by) osmoreceptors/hypothalamus (1) • pituitary gland (1) • (releases more) ADH (1) • ADH acts on the nephron/collecting duct/tubules (1) • making the {collecting duct/tubules/nephron} more permeable (1) • so **more** water is reabsorbed (by the body/blood) (1)	ignore brain accept {small amount/concentrated} urine produced	**(4)**

Question Number	Answer	Acceptable answers	Mark
5(b)(i)	**A** corpus luteum		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)(ii)	• uterus lining remains thick/uterus lining continues to grow (1)		**(1)**

Question Number		Indicative Content	Mark
QWC	**5(b)(iii)***	A explanation to include some of the following points Stages and hormones • menstrual cycle consists of menstruation, uterus lining thickening and ovulation • hormones involved in the menstrual cycle are oestrogen, progesterone, FSH and LH Role of the hormones • FSH stimulates the follicles to mature • FSH stimulates the production of oestrogen • follicles secrete oestrogen • oestrogen is responsible for the repair of the uterus wall • high levels of oestrogen stimulate the release of LH • LH triggers ovulation • corpus luteum produces progesterone • progesterone maintains the lining of the uterus Control mechanisms • oestrogen inhibits the production of FSH • progesterone inhibits the production of LH • progesterone inhibits the production of FSH • menstruation is triggered by low levels of oestrogen and progesterone • Low progesterone levels cause FSH to be released	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• A limited explanation of the menstrual cycle which might include at least one of the stages **or** some of the hormones involved **or** the role of one of the hormones involved • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• A simple explanation of the menstrual cycle including some of the stages **and** the role of at least two of the hormones involved • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• A detailed explanation of the menstrual cycle including most of the hormones involved, their roles **and** at least one control mechanism • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

(Total for question 5 = 12 marks)

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	ligase	accept reasonable misspellings e.g. lygase reject lipase	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	Two from the following • leaves single stranded ends /overhangs / sticky ends (1) • complementary / bases pair up (1) • hold gene in place while ligase joins the DNA / makes inserting gene into plasmid more successful (1)	accept (single stranded DNA) matches up ignore join together easily	**(2)**

Question Number		Indicative Content	Mark
QWC	***6(b)**	A description to include some of the following points Sweets • made using invertase/sucrase • converts sucrose into glucose and fructose • reduces viscosity of sugar mixture • increases simple sugar content, increasing sweetness • production of soft centred sweets • production of lower calorie sweets Vegetarian Cheese • made using chymosin • produced by genetically modified organisms • Chymosin initiates clotting/protein coagulation • reduces the use of rennet extracted from animals Lactose free milk • made using lactase • using immobilised enzymes • lactose converted to galactose and glucose • beneficial to people with lactose intolerance	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description of the use of enzymes in the production of at least one food **or** naming an enzyme linked to its use • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description of at least two food products linked to their named enzyme **or** a detailed description of the production of one food including the name and role of the enzyme • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description of most stages of the production of two or more food products made using enzyme technology including the name and role of the enzymes • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(c)	A description including two from the following **digestive** enzymes/named digestive enzyme (1) breakdown **named biological** stain (1) stains into soluble products (1)		**(2)**

(Total for question 6 = 11 marks)

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Write your name here

Surname	Other names

Centre Number | Candidate Number

Edexcel GCSE

Biology

Unit B3: Using Biology

Higher Tier

Monday 20 May 2013 – Afternoon
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.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 4 1 9 3 5 A 0 1 1 6

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Answer ALL questions

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

Survival

1 Elk, *Alces alces,* are members of the deer family.

Elk mate in the autumn and their calves are born in the spring.



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

During the mating season males make sounds to attract females.

This type of behaviour is part of

(1)

- ☒ **A** conditioning
- ☒ **B** courtship
- ☒ **C** habituation
- ☒ **D** imprinting

(ii) Females are also attracted to males by the size of their antlers.

Suggest why a male elk may move away if challenged by another male with larger antlers.

(1)

.....

.....

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(b) A pregnant elk will search for a group of thick bushes in which to give birth.

Explain an advantage of this behaviour.

(2)

(c) (i) Some plants produce tannins.

Tannins are toxic. The tannins stop some herbivores from eating these plants.

Elk produce proteins in their saliva which bind to the tannins and make them inactive.

This inter-relationship is a product of co-evolution.

Describe the advantages to the elk of producing tannin-binding proteins in their saliva.

(2)

(ii) The development of flower structure and insect behaviour is another example of co-evolution.

Describe how this relationship benefits the plant.

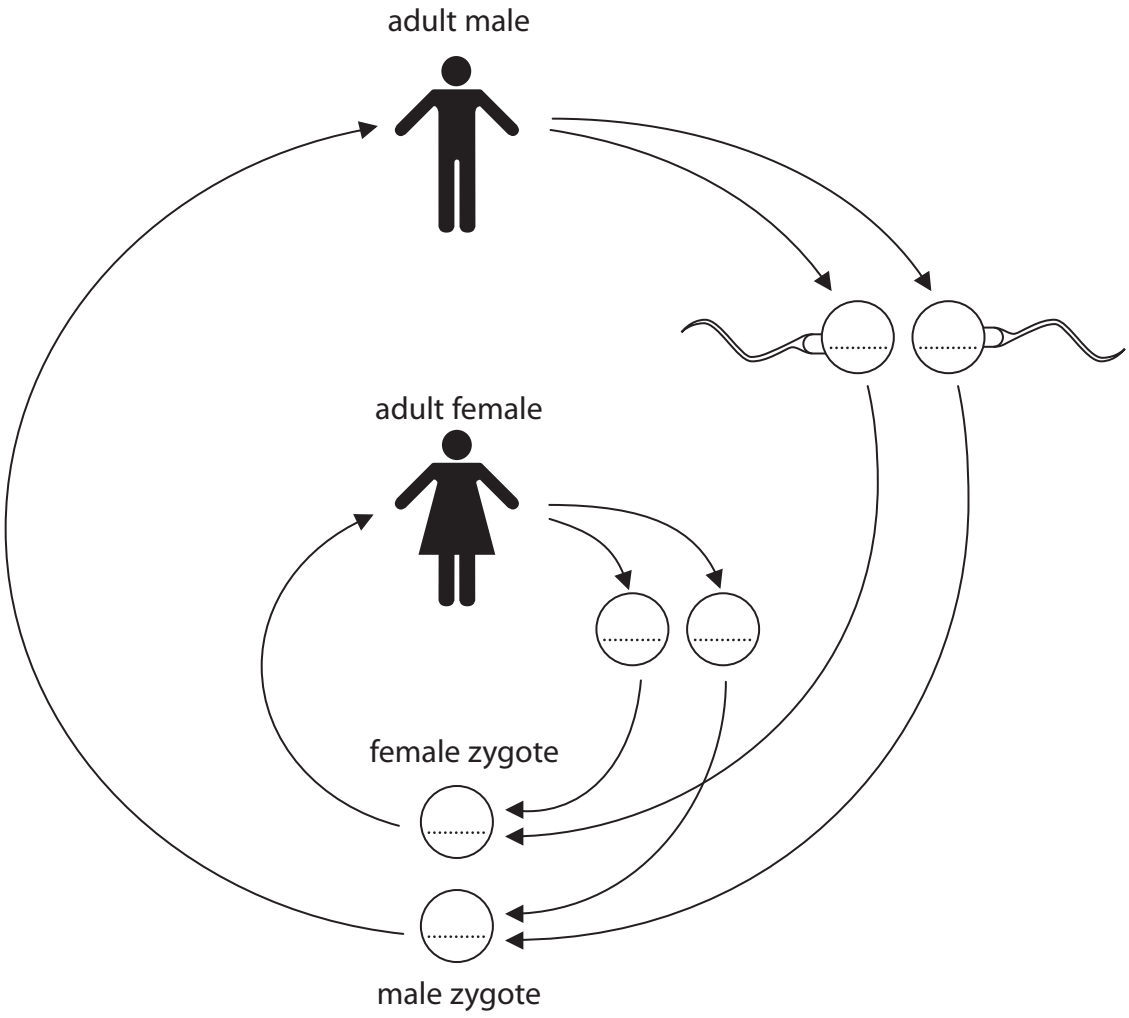
(2)

(Total for Question 1 = 8 marks)

Human reproduction

2 The diagram shows the human life cycle.

When a sperm cell fertilises an egg cell, a zygote is formed.

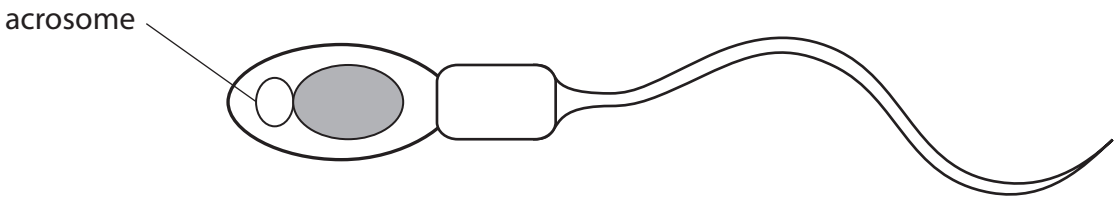


(a) Complete the diagram by writing the sex chromosomes in the egg cells, sperm cells, male zygote and female zygote.

(2)

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(b) The diagram shows a sperm cell.



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

The acrosome contains

(1)

☒ **A** enzymes to help get through the membrane of the egg cell

☒ **B** mitochondria to supply energy to swim

☒ **C** muscle fibres to swim

☒ **D** 23 chromosomes

(c) State why egg cells have a large amount of cytoplasm.

(1)

.....

.....

(d) During ovulation an egg cell is released from the ovary.

Explain how changes in the levels of hormones result in ovulation.

(2)

.....

.....

.....

.....

(e) Explain what happens to the uterus lining if the egg cell is fertilised.

(2)

.....

.....

.....

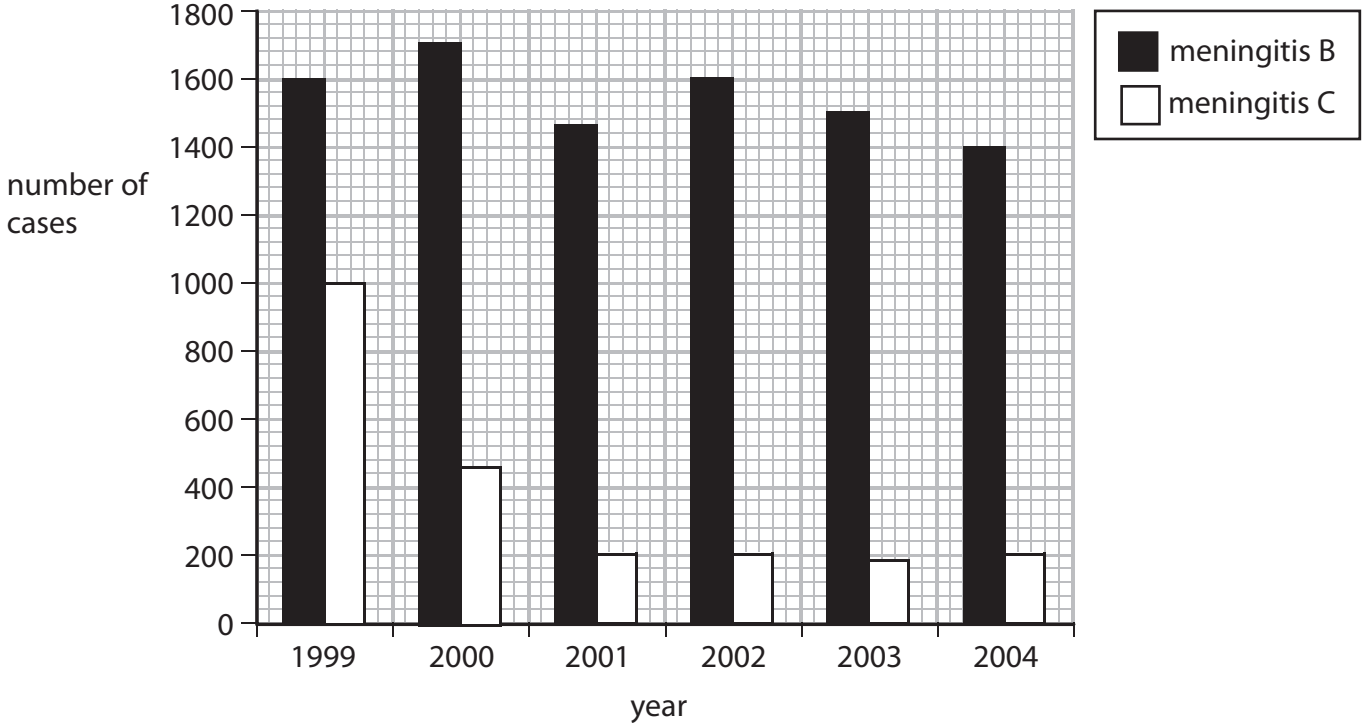
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(Total for Question 2 = 8 marks)

Immunisation

3 Meningitis B and meningitis C are caused by bacteria.

The graph shows the number of cases of meningitis B and meningitis C in England, from 1999 to 2004.



(a) (i) Use the graph to calculate the change in the total number of cases of meningitis in 1999 compared with 2004.

(2)

answer = ...

(ii) Immunisation against meningitis C was introduced in 1999.

Describe the effects the immunisation had on the number of cases of both types of meningitis.

(2)

.....

.....

.....

.....

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

The molecules on pathogens which cause an immune response are called

(1)

☒ **A** antigens

☒ **B** bacteria

☒ **C** hybridomas

☒ **D** lymphocytes

(c) (i) Monoclonal antibodies can be produced in large quantities.

Describe the steps in producing monoclonal antibodies.

(3)

(ii) Explain the advantage of using monoclonal antibodies to treat cancer.

(2)

(Total for Question 3 = 10 marks)

Animal behaviour

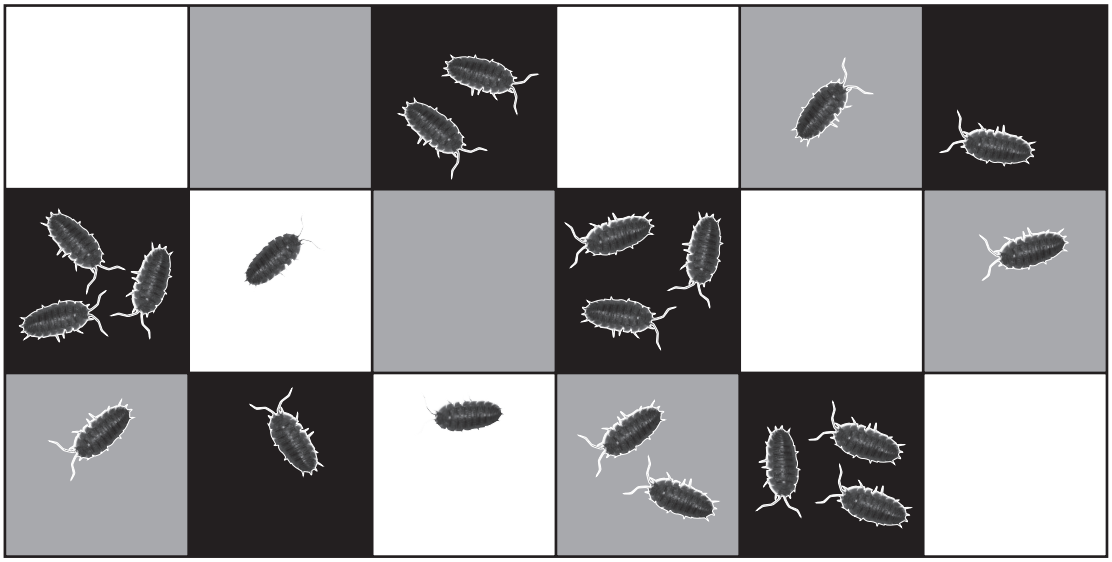
4 Woodlice are small animals that live in and under rotting wood.

20 woodlice were taken from a pile of logs in a forest and placed in the centre of a tray.

The tray had black, dark grey and white squares painted on the bottom.

The diagram shows where the woodlice were 30 minutes later.

Key:  = woodlice



(a) Calculate the percentage of woodlice found on the black squares.

(2)

answer = ...%

(b) The woodlice move quickly on the light squares and slow down on the dark squares.

All woodlice show this behaviour.

State the term used to describe this type of behaviour.

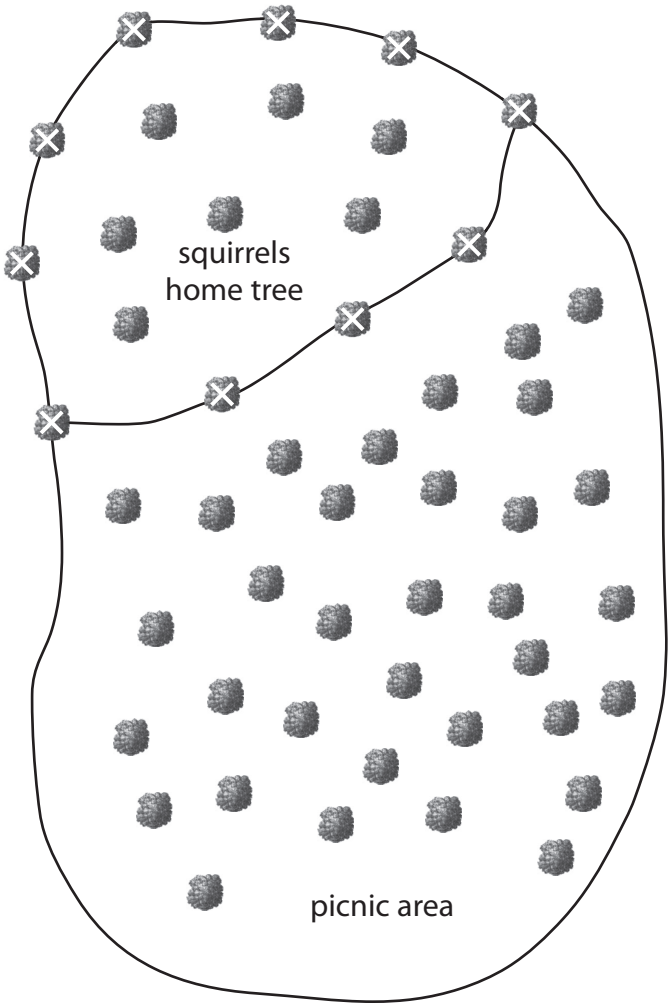
(1)

.....

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(c) A pair of squirrels in a forest were studied for four months.

The map shows part of the forest including the area where the squirrels lived.



(i) The squirrels were observed to urinate regularly on particular trees.

The trees on which they urinated are marked on the map with an X.

Explain how this behaviour benefits the squirrels.

(3)

(ii) The squirrels being studied ran away from people. Other squirrels that lived by the picnic area did not run away.

A scientist suggested that the squirrels near the picnic area had become used to people because the people did not harm them.

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

This type of behaviour is called

(1)

☒ **A** classical conditioning

☒ **B** habituation

☒ **C** imprinting

☒ **D** courtship

(iii) Another scientist suggested that the squirrels that lived near the picnic area were showing operant conditioning.

Describe what is meant by the term operant conditioning.

(3)

(Total for Question 4 = 10 marks)

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Question 5 is on the next page

Healthy foods

5 (a) Mycoprotein is one type of food produced using biotechnology.

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

The microorganism used in the production of mycoprotein is

(1)

☒ **A** *Agrobacterium*

☒ **B** *Bacillus*

☒ **C** *Fusarium*

☒ **D** *Saccharomyces*

(ii) The table shows the mass of different nutrients in 100 g of mycoprotein mince and 100 g of minced beef.

nutrient	mass of nutrient in 100 g of mycoprotein mince / g	mass of nutrient in 100 g of minced beef / g
protein	13.5	20.0
carbohydrates	12.0	1.0
fat	7.0	16.0
fibre	3.5	0.0
salt	1.0	0.7

Calculate the difference in the mass of protein contained in 200 g of minced beef compared with 200 g of mycoprotein mince.

(2)

answer = ... g

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(iii) Mycoprotein mince has nutritional advantages compared with minced beef.

State **one** nutritional advantage of mycoprotein.

(1)

(b) Explain **one** advantage, other than a nutritional benefit, of using microorganisms to produce food.

(2)

*(c) Fermenters are used to grow microorganisms.

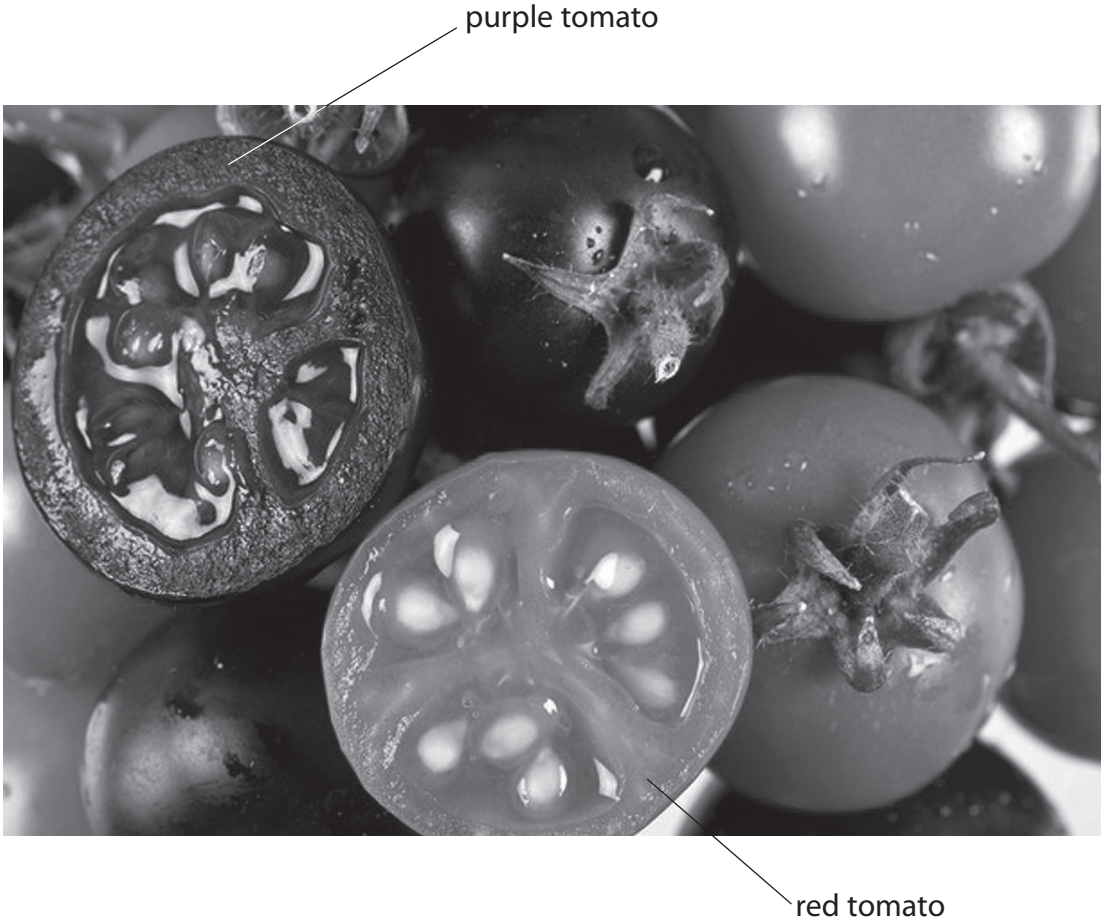
Explain how optimum conditions for the growth of microorganisms are controlled in a fermenter.

(6)

(Total for Question 5 = 12 marks)

Genetic modification of crops

6 (a) Purple tomatoes are transgenic plants that have been produced by genetic engineering.



(i) As a result of genetic modification, these tomatoes produce a new substance which has health benefits and turns the tomatoes purple.

Name this substance.

(1)

.....

(ii) What is inserted into the DNA of another plant to make it transgenic?

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

(1)

☒ **A** a gene from another species

☒ **B** a gene from the same species

☒ **C** chromosomes from the same species

☒ **D** proteins from another species

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*(b) Describe how *Agrobacterium tumefaciens* can be used to create transgenic plants.

(6)

(c) *Bacillus thuringiensis* contains a gene that codes for a toxin.

Explain **one** advantage and **one** disadvantage of introducing this gene into crop plants.

(4)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2013

GCSE Biology (5BI3H)
Paper 01

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- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	**B** ☒ courtship		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	avoid injury / do not waste energy	avoid a fight idea of dominance / submission feels threatened Ignore : female will pick the biggest antlers / respect	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)	An explanation linking • protection (of female during birth / of young) / concealment (1) • from predators / until strong enough (to fend for itself) (1)	 safer camouflaged weather	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c) (i)	A description including two of the following • can eat plants which contain tannins (1) • larger food supply (1) • plants not consumed by other herbivores / less competition from other herbivores / animals (1)	 get more food / less likely to starve / won't starve	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c) (ii)	A description including • (flower) attracts insects (1) • which pollinate the flower (1) • Idea that insect - flower relationship is specific (1)	attraction can be specific in terms of colour, size or scent or nectar or pollen fertilise / reproduce for pollinate e.g. bee and bee orchid	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)	Gametes correctly labelled (1) X X X Y Female zygote X X Male zygote X Y (1)	X X Y X	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)	**A** ☒ enzymes to help get through the membrane of the egg cell		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)	to supply / contain (a large amount of) nutrients / energy (for the zygote / embryo)	food /named nutrient Ignore references to foetus Reject baby	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(d)	An explanation linking **two** of the following: • rising oestrogen levels (1) • (stimulate production of) LH (1) • (LH) levels increase / when it reaches a set level / peaks (which causes ovulation) (1)	accept high oestrogen levels / oestrogen peaks / oestrogen released	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(e)	An explanation linking: • Uterus lining maintained/ thickened (more) (1) With one of: • Because progesterone levels maintained / progesterone is still produced • So that the embryo can embed on it / So that the uterus lining can supply the embryo with nutrients	Reject: repairs	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	(1600 + 1000) – (1400 + 200) Or 2600 – 1600 Or (1600 – 1400) + (1000 – 200) or 200 + 800 (1) = 1000	2 marks for bald answer - 1000	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	Description including **two** of the following: • no (overall) / little effect on cases of meningitis B (1) • (significant overall) decrease in meningitis C (1) • correct manipulation of data (1)	fluctuates a little / rises and then goes slightly down	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)	**A** ☒ antigens		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	A description linking three of the following • inject mammal / named mammal with antigen (1) • (select) B lymphocytes / lymphocyte that produces the (specific) antibody / spleen cells(1) • fuse with tumour / myeloma cells (1) • (to produce a) <u>hybridoma</u> (which divide)(1) • antibodies are isolated / screened(1)	Accept animal for mammal Accept B cells Accept cancer cells Ignore antibodies produced	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	An explanation linking **two** of the following: • antibody (only) attach to cancer cell (1) • drug / radioactive source / toxin bound to antibody / alerts immune system to target cancer cells (1) • no / fewer adverse effect to non cancerous cells (1)	Accept named effect	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)	13 (1) 65 (%)	Two marks for correct bald answer	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)	innate / instinctive / inherited	Kinesis Ignore positive / negative Reject taxis	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	An explanation linking **three** of the following: • the squirrels are marking their territory (1) • using chemical markers / chemical signals / pheromones / scent (1) • which reduces conflict (1) • reduces competition / results in more food for these squirrels / the offspring (1)	Accept area for territory Keep other squirrels away / out Ignore comments re scaring predators away / attracting mates / finding way home.	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	B habituation		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(iii)	A description including **three** of the following: • random / chance behaviour (1) • (specific / repeated) behaviour rewarded (1) • animal associates (reward with behaviour) (1) • behaviour reinforced (1) • (eventually) behaviour occurs without reward / infrequent reward / learned behaviour(1)	Credit: operant behaviour in context of squirrels or other animals Trial and error behaviour Accept operant condition in terms of negative reinforcement / punishment	**(3)**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	**C** ☒ *Fusarium*		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	20 and 13.5 OR 40 and 27 (1) = 13.0	2 marks for correct bald answer	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(iii)	higher in fibre / source of fibre / lower in fat (than minced beef)	high in fibre lower in saturated fat / cholesterol Reject references to more salt / less protein Ignore refs to more carbohydrate	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)	An explanation linking two of the following: • produce a large (food) supply / quicker food production(1) • rapid population growth of microorganisms (1) OR • produced anywhere in world / large food supply/quicker food production (1) • independent of land /climate conditions / use less land or space(1) OR • reduced cost of production (1) • use waste products from industrial processes/doesn't incur cost of vet / eq(1) OR • makes vegetarian food products (1) • as a meat substitute (1)	grow / reproduce quickly Ignore references to cheaper unless qualified accept animals are not harmed in production	**(2)**

Question Number		Indicative Content	Mark
QWC	***5(c)**	An explanation including some of the following points: • water (cooling) jacket • temperature probe • to maintain an optimum temperature • inlet pipes for nutrients eg ammonia • to supply microorganism with food source eg materials to make proteins • oxygen pumped in • for aerobic microorganisms or aerobic respiration • carbon dioxide removed • pH probe • alkali added to raise pH • maintain optimum pH • paddles • to evenly distribute nutrients, oxygen and break up clumps of microorganisms • aseptic conditions • to prevent contamination of the fermenter • reduce competition	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation which includes one feature of a fermenter with its justification, or two features of a fermenter or two justifications • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple explanation which includes at least **two** features of the fermenter with justification for their use • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation which includes at least **four** features of the fermenter with justification for their use • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(a) (i)	flavonoids / bioflavonoids	anthocyanins antioxidants	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a) (ii)	**A** ☒ a gene from another species		**(1)**

Question Number		Indicative Content	Mark
QWC	***6 (b)**	A description including some of the following points **genetic modification** • transferring a gene from one organism to another • restriction enzymes to cut the gene out • plasmids used to carry gene • sticky ends to join complementary bases • ligase to join the DNA **use of *Agrobacterium*** • *Agrobacterium* is a vector (for the gene) • the *Agrobacterium* has a suitable gene added to it • example of a suitable gene eg drought resistance / insect resistance / larger yield / for flavonoids • *Agrobacterium* naturally invades plant cells • its DNA is incorporated into the plant's DNA **production of plants** • plant sprayed with *Agrobacterium* • crown gall (formed) • crown gall is cut into small pieces • leaf discs are incubated with *Agrobacterium* • (crown gall tissue / leaf discs) grown in tissue culture • explants • grown into crops	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description of at least **one** of the areas involved in creating transgenic plants. Steps may be missing or out of sequence. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description of at least **two** of the areas involved in creating transgenic plants or a detailed description of **one** area involved in creating transgenic plants • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description of the genetic modification, use and production of transgenic plants. Steps should be in sequence. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(c)	An explanation of one advantage for **two** marks • crop produces a toxin that kills insects (that eat plant)(1) • so less damage by insect / increased crop yield (1) • less man-made chemicals used / specific to pests / less pollution (1) An explanation of one disadvantage for **two** marks • cross pollination / fertilisation with other plants (species) (1) • producing weeds that contain the toxin(1) • non target organisms may be affected (1) OR • idea of large areas of monocultures (1) • reduction in insect numbers / biodiversity (1) • negative impact on food chains (1) OR • GM crops cost more (1) • Farmers cannot afford them / become reliant on them (1)	accept references to ICP accept does not kill other insects	**(4)**

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