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EDEXCEL GCSE BIOLOGY: QUESTIONS BY TOPIC

Natural Selection and Genetic Modification (4)

GCSE Biology (Foundation) Topic 4

9 questions · 88 marks · Mark schemes included

Pearson Edexcel GCSE (9-1) Biology 1BI0, Foundation Tier, June 2018 - June 2025

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HOW TO USE THIS BOOKLET

Questions run from the lowest mark tariff to the highest, so similar questions sit together.

Click any row below to jump straight to that question.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme.

Diagrams, graphs, tables and data are printed exactly as they appeared in the original papers.

QUESTION	SOURCE	MARKS	PAGE
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QUESTIONS

9 questions · 88 marks · lowest tariff first



8-MARK QUESTIONS

2 questions in this booklet



3 The book 'On the Origin of Species' was published in 1859.

This book describes the theory of evolution.

(a) (i) Which scientist wrote this book explaining his theory of evolution?

(1)

☐ **A** Charles Darwin

☐ **B** Robert Hooke

☐ **C** Richard Leakey

☐ **D** Gregor Mendel

(ii) Which statement is supported by this theory of evolution?

(1)

☐ **A** humans are not related to any other group of animals

☐ **B** all species have the same genes

☐ **C** a meteor caused the dinosaurs to evolve

☐ **D** new species evolve over many generations



(b) One chapter of this book discusses pentadactyl limbs.

Figure 5 shows the bones of the pentadactyl limbs of three mammals.

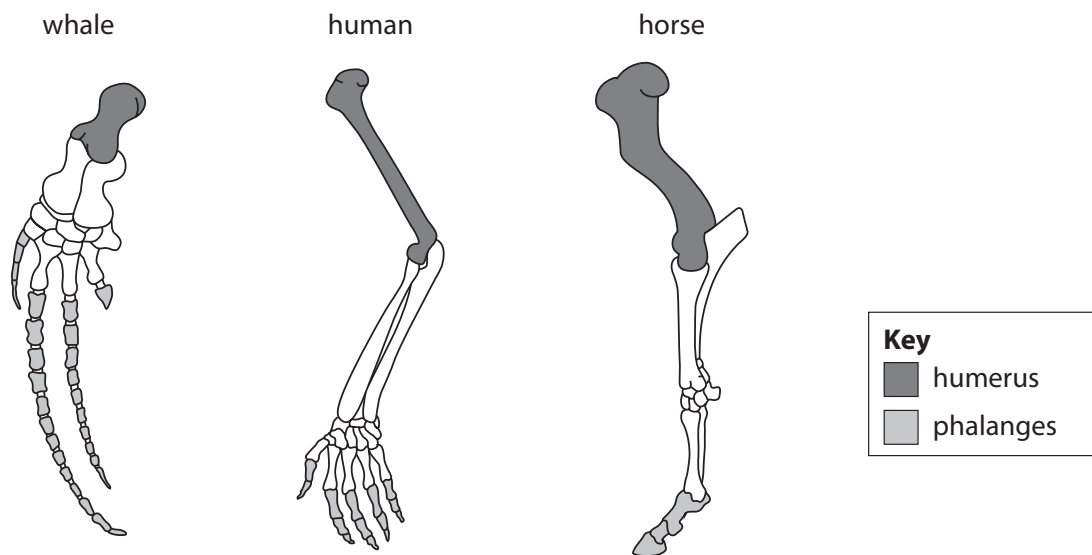


Figure 5

(i) Describe **one** difference between the humerus of the whale and the humerus of the human.

(1)

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(ii) Describe **one** difference between the phalanges of the horse and the phalanges of the human.

(1)

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- (c) Another chapter of the book discusses how the shape of bird beaks has evolved on different islands.

Figure 6 shows two species of finch from two different islands.



(Source: © Kristel Segeren/Shutterstock)

Species A



(Source: © Maurizio De Mattei/Shutterstock)

Species B

Figure 6

These two species of finch evolved from a common ancestor that had a similar shaped beak to species B.

Beak shape is related to the food that the finches eat.

Describe how the thinner beak of species A is a result of evolution.

(4)

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(Total for Question 3 = 8 marks)

- 3 (a) Figure 6 shows the bones in the limbs of a bird and a whale.

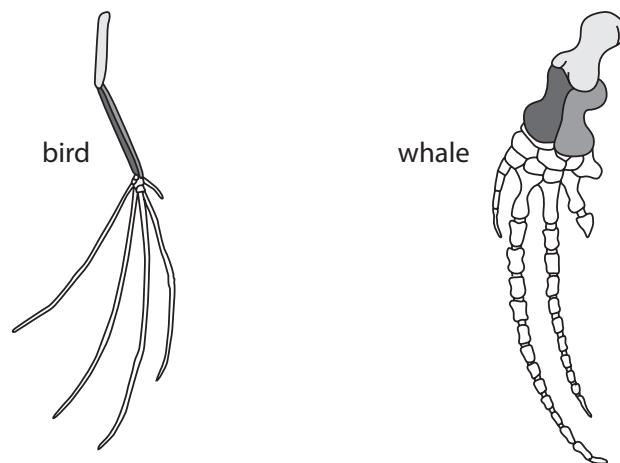


Figure 6

- (i) The bird and the whale have evolved from a common ancestor.

Give **one** way the structure of these limbs provides evidence for this evolution.

(1)

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- (ii) Charles Darwin developed the theory of evolution by natural selection.

Which scientist worked with Darwin on the theory of evolution by natural selection?

(1)

- ☐ **A** Alexander Fleming
- ☐ **B** Gregor Mendel
- ☐ **C** Richard Leakey
- ☐ **D** Alfred Russel Wallace

(b) DNA is found in bones and stem cells.

(i) Suggest **one** reason why DNA is found in bones.

(1)

(ii) Describe how stem cells help animals to grow.

(2)

(iii) Scientists have transplanted stem cells into the retina of the eye.

Name **one** type of light sensitive cell found in the retina.

(1)

(iv) Explain **one** reason for transplanting stem cells into the retina.

(2)

(Total for Question 3 = 8 marks)



9-MARK QUESTIONS

2 questions in this booklet



- 3 (a) Figure 5 shows the area of land used to grow genetically modified (GM) crops worldwide from 2005 to 2014.

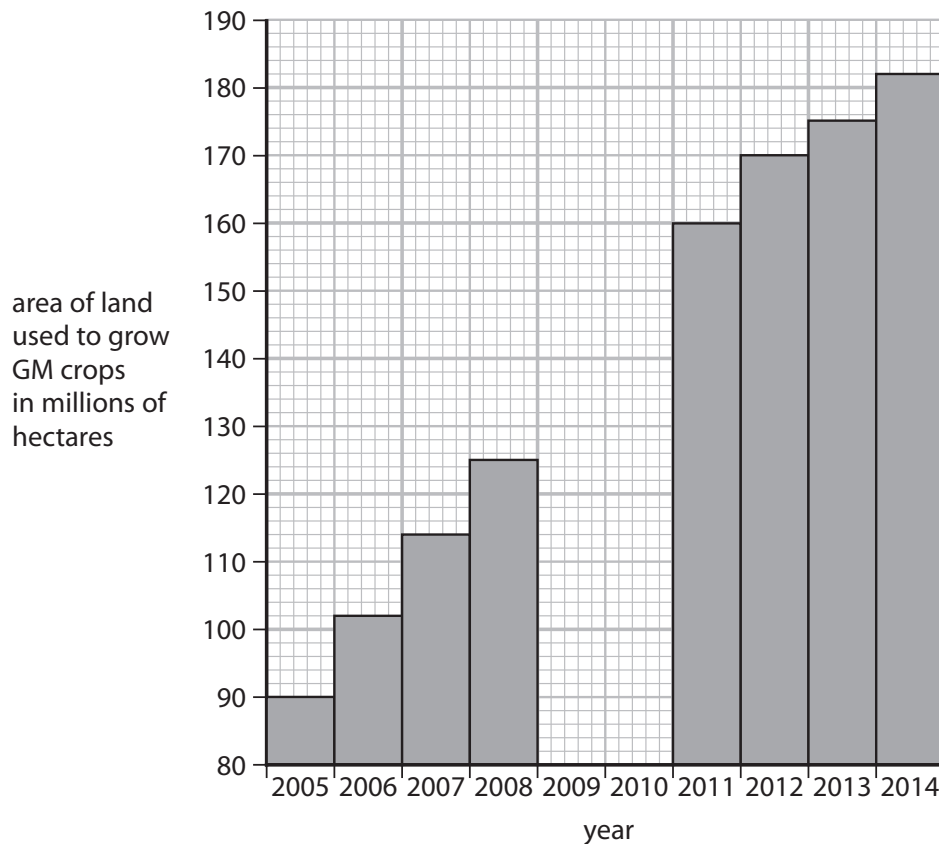


Figure 5

- (i) In 2009, the area of land used was 134 million hectares and in 2010 the area of land was 147 million hectares.

Complete Figure 5 by drawing bars to show the area of land used in 2009 and 2010.

(2)

- (ii) Describe the trend shown by the data in Figure 5.

(2)

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(b) GM crops often produce a larger yield than non-GM crops.

Give **one** reason why this could reduce the destruction of forests.

(1)

(c) The ladybird is a predator.

Aphids are insect pests.

Figure 6 shows a ladybird feeding on aphids.



© Aleksandar Kitanovic/123RF

Figure 6

(i) Using ladybirds to control insect pests is an example of

(1)

- ☐ **A** chemical control
- ☐ **B** enzyme technology
- ☐ **C** biological control
- ☐ **D** tissue culture

(ii) Explain **one** advantage of using predators to control insect pests.

(2)

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(d) Some crop plants are genetically modified to make them resistant to attack by insect pests.

State **one** disadvantage of genetically modified crop plants.

(1)

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(Total for Question 3 = 9 marks)



- 5 Figure 9 shows a plant with plantlets growing from it.

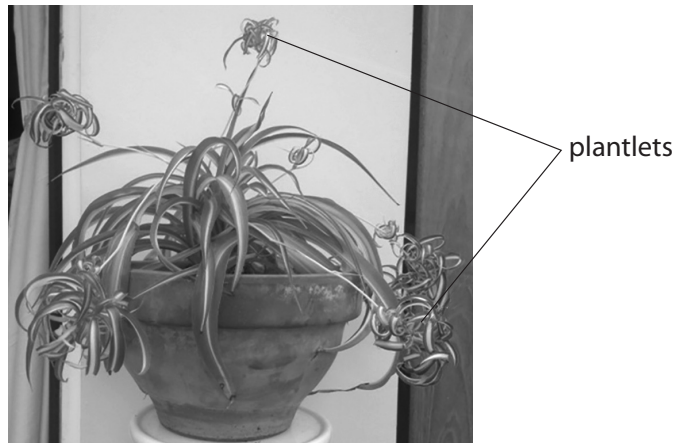


Figure 9

If a plantlet touches soil, it will grow roots and become a new plant.

This is an example of asexual reproduction.

- (a) State **one** advantage of asexual reproduction for this plant.

(1)

- (b) Scientists investigated how temperature affected the number of plantlets produced by this type of plant in 10 weeks.

The scientists grew one of these plants in each of six temperatures.

Figure 10 shows the results.

Temperature in °C	Number of plantlets produced
5	0
10	0
15	2
20	12
25	8
30	0

Figure 10



- (i) Describe the effect of temperature on the number of plantlets produced by these plants.

(2)

- (ii) Which of these would improve the results of this investigation?

(1)

- ☐ **A** grow a plant at 0°C
- ☐ **B** grow each plant in a different type of soil
- ☐ **C** grow a different species of plant at each temperature
- ☐ **D** grow five of these plants at each temperature

- (c) The plant in Figure 9 also produces flowers for sexual reproduction.

Explain **one** advantage of sexual reproduction.

(2)

(d) Figure 11 shows the characteristics of three different varieties of this plant.

characteristic	plant K	plant L	plant M
size of leaves	small	large	small
striped leaves	none	none	green and white
flowers	small white	large white	large pink

Figure 11

A gardener wants to use selective breeding to produce a plant with large green and white striped leaves and large white flowers.

Explain which plants the gardener should use.

(3)

(Total for Question 5 = 9 marks)

10-MARK QUESTIONS

2 questions in this booklet



- 5 (a) Farmers selectively breed chickens to produce larger chickens.

Figure 9 shows how the size of chickens has changed over time.

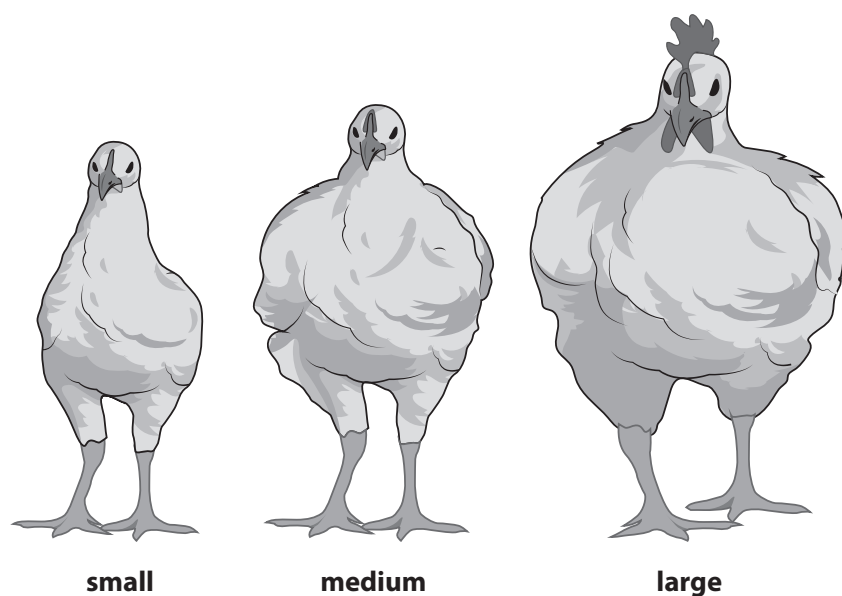


Figure 9

- (i) Explain how farmers have used selective breeding to produce larger chickens.

(3)

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(ii) Describe **one** benefit and **one** risk of selectively breeding chickens.

(2)

benefit.....

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risk.....

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(b) The body cells of chickens have 78 chromosomes in their nuclei.

(i) State the number of chromosomes found in each sex cell of a chicken.

(1)

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(ii) Name the type of cell division which produces sex cells.

(1)

.....

(c) (i) What is the correct definition of a genome?

(1)

- ☐ A all the cells of an organism
- ☐ B all the enzymes of an organism
- ☐ C all the genetic material of an organism
- ☐ D all the cytoplasm of an organism



- (ii) A new project called the Earth BioGenome Project aims to discover the sequence of bases in the DNA for all plants and animals.

State **two** benefits of discovering the sequence of bases for all plants and animals. (2)

1.

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2.

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(Total for Question 5 = 10 marks)



4 Scientists think that chickens were domesticated from red junglefowl thousands of years ago.

Figure 6 shows some information about these birds.

information	red junglefowl	domesticated chicken
photograph	 (Source: © Jamil Bin Mat Isa/ Shutterstock)	 (Source: © Tsekhmister/ Shutterstock)
mass of adult in kg	0.75 to 1.2	2.5 to 3.0
number of eggs laid per year	10 to 15	250 to 300

Figure 6

(a) Describe how selective breeding has produced chickens that lay large numbers of eggs.

(3)

(b) Chickens have 78 chromosomes in each of their body cells.

These chromosomes are in pairs.

(i) Which term describes a chicken body cell?

(1)

☐ A dominant

☐ B haploid

☐ C recessive

☐ D diploid

(ii) State the number of chromosomes found in the gametes produced by chickens.

(1)

(c) Complete the table to compare the production of body cells and gametes.

One box has been completed for you.

(3)

type of cell produced	type of cell division	number of daughter cells produced
body cell	mitosis	
gamete		

(d) Some animal cells are stem cells.

Describe the function of stem cells.

(2)

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(Total for Question 4 = 10 marks)

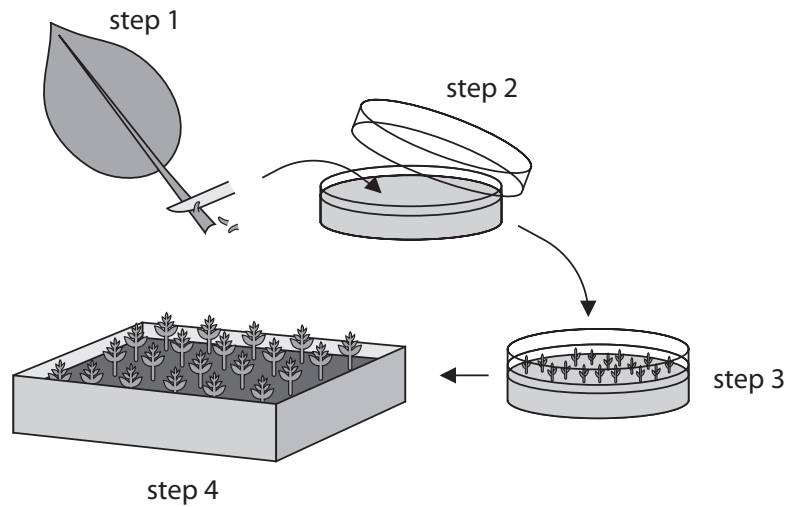


11-MARK QUESTIONS

2 questions in this booklet



10 (a) Figure 15 shows a method of producing plants.



Step 1. Cells taken from parent plant.

Step 2. Cells placed on agar growth medium.

Step 3. Cells develop into tiny plantlets.

Step 4. Plantlets grown in compost.

Figure 15

(i) Some cells in each plantlet develop into root cells.

Name the process occurring as these cells develop into root cells.

(1)

(ii) Describe the advantages of producing plants by the method shown in Figure 15.

(2)

(iii) An autoclave is used to prepare the agar growth medium used in Step 2.

Explain why the agar growth medium is autoclaved.

(2)

(iv) One of the plantlets had different coloured leaves.

Give **one** reason why this plantlet had different coloured leaves.

(1)



(b) Crop plants provide a source of energy in the form of carbohydrates such as starch and sugars.

(i) Describe the test to identify starch.

(2)

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- (ii) The amount of energy in the sugars extracted from crop plants can be measured using the calorimeter shown in Figure 16.

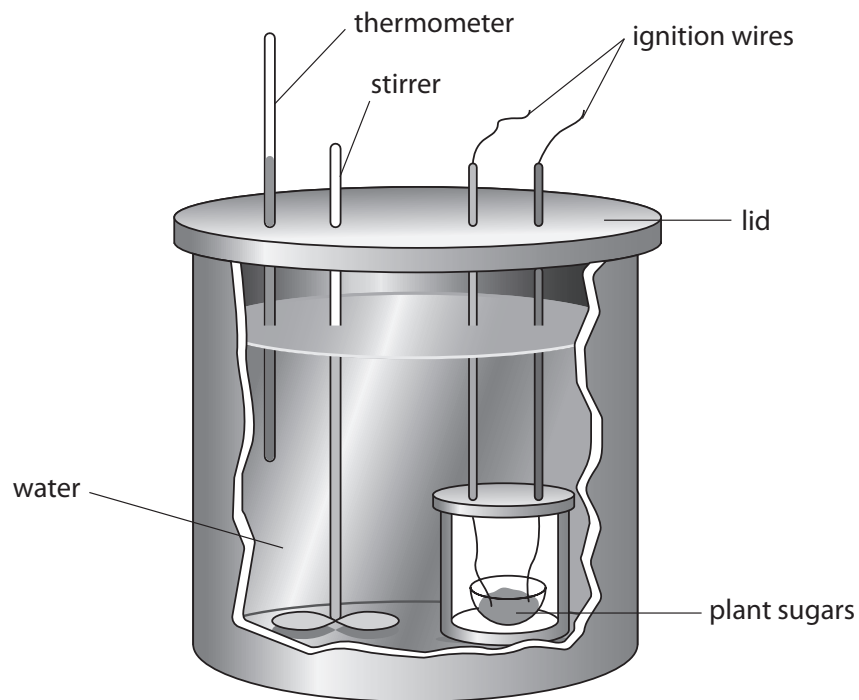


Figure 16

Explain why the calorimeter has a lid.

(2)

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- (iii) State why it is important to stir the water in the calorimeter.

(1)

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(Total for Question 10 = 11 marks)

7 (a) Figure 14 shows the limbs of some animals.

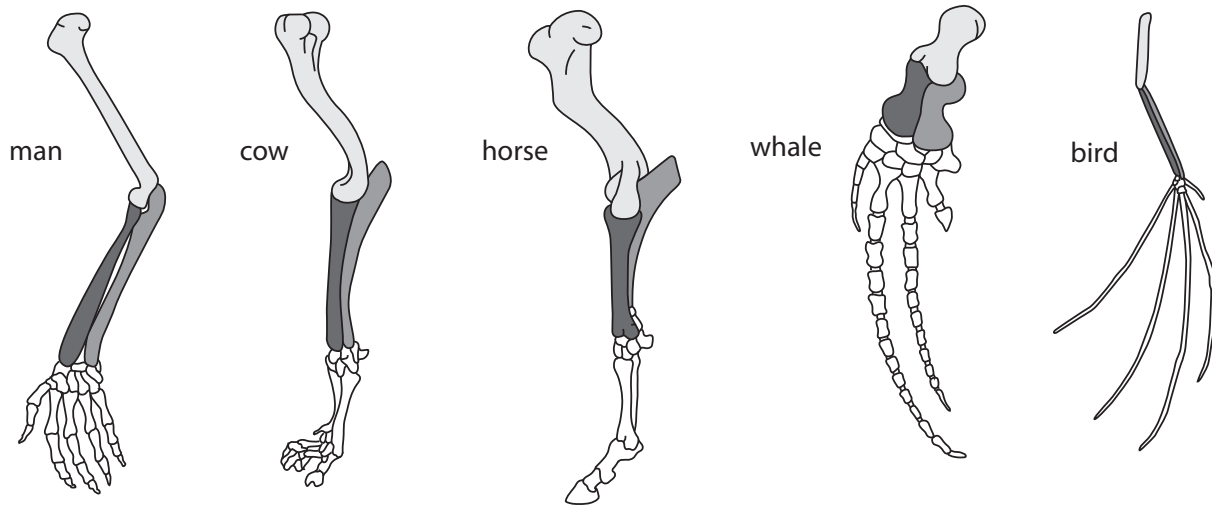


Figure 14

Describe how these limbs provide evidence for evolution.

(2)

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(b) Prickly pear cacti are weeds that grow in many countries.

Insects have been used to limit the population of prickly pear cacti.

Figure 15 shows some insects on a prickly pear cactus.



(Source: © Catherine Eckert/Shutterstock)

Figure 15

(i) Which is the name of this method of limiting the population of weeds?

(1)

- ☐ A biological control
- ☐ B chemical control
- ☐ C tissue culture
- ☐ D genetic engineering

(ii) Give **two** benefits of using insects, rather than chemicals, on prickly pear cacti.

(2)

1

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2

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*(c) Some crop plants have been genetically modified to be resistant to insect pests.

Explain the advantages and disadvantages of producing genetically modified crop plants.

(6)

(Total for Question 7 = 11 marks)



12-MARK QUESTIONS

1 question in this booklet



7 Tissue culture can be used to grow cells.

(a) (i) State **one** difference between normal body cells and cancer cells.

(1)

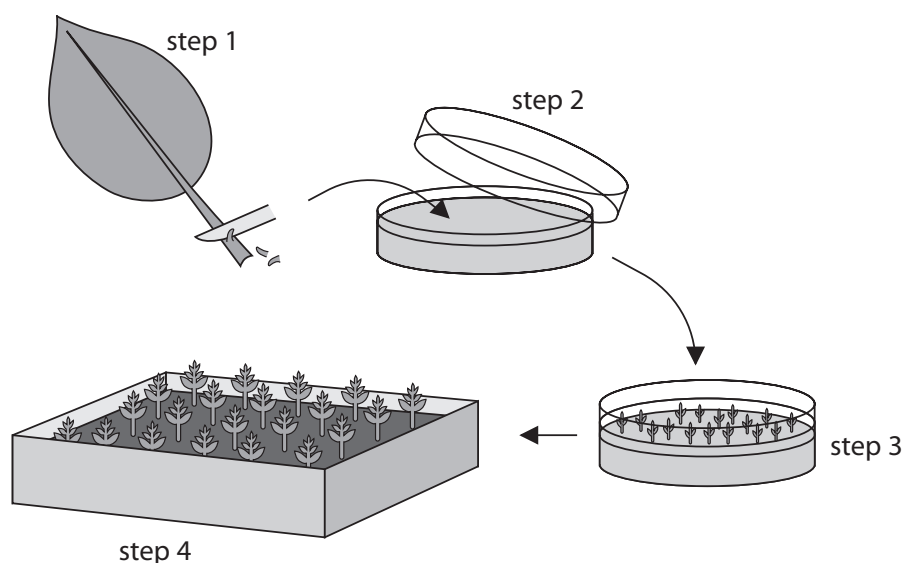
(ii) Cancer cells can be grown in tissue culture.

Give **one** disadvantage of testing drugs on these cancer cells.

(1)

(b) Tissue culture can be used to conserve rare plants.

Figure 13 shows some of the stages involved.



Step 1: Cells are taken from a rare plant.

Step 2: The cells are placed on sterile growth medium.

Step 3: The cells develop into small plantlets with roots and stems.

Step 4: The plantlets are grown in compost.

Figure 13

(i) State **one** way the growth medium can be sterilised.

(1)

(ii) Explain **one** reason why the growth medium must be sterilised.

(2)

(iii) Suggest **one** advantage of using tissue culture to conserve rare plants.

(1)



*(c) Figure 14 shows some plant structures that protect plants from attack by pests and pathogens.

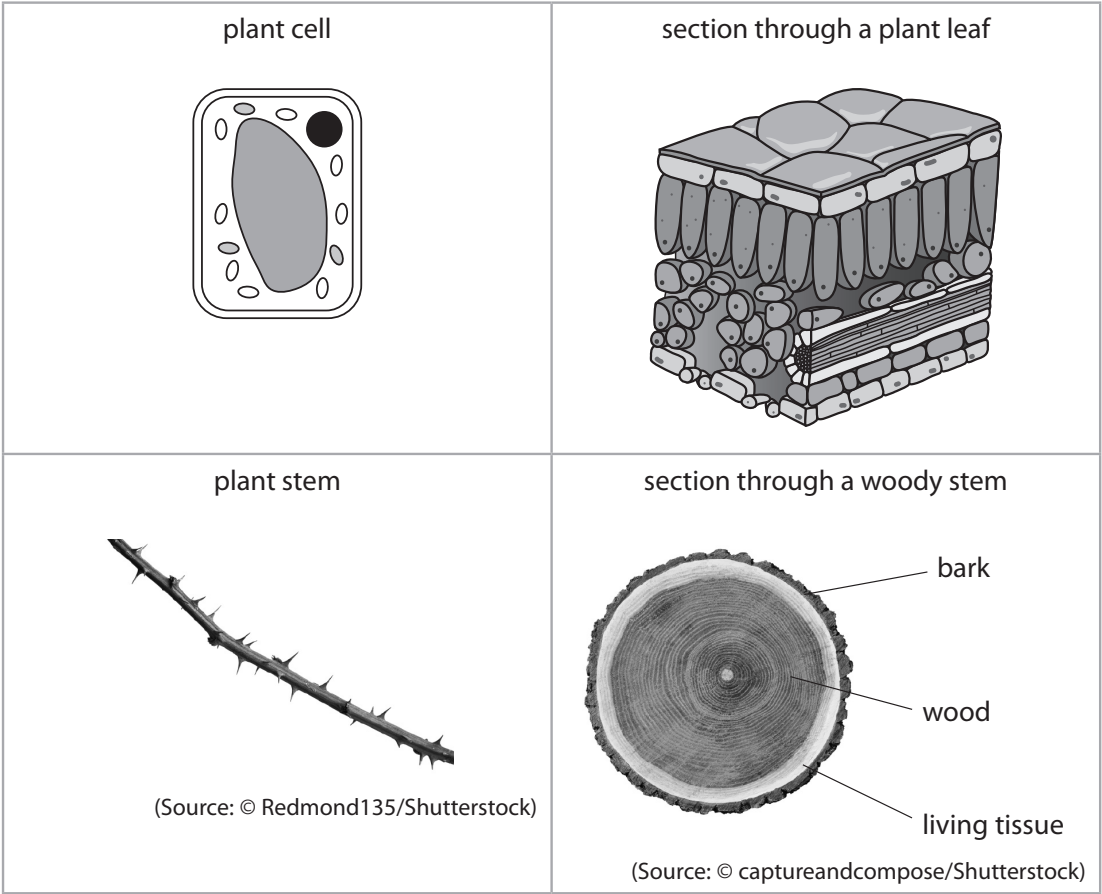


Figure 14

Describe how physical barriers protect plants from attack by pests and pathogens.

Use information from Figure 14 in your answer.

(6)

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(Total for Question 7 = 12 marks)



MARK SCHEMES

official Pearson Edexcel mark schemes



Question number	Answer	Mark
3 (a)(i)	A Charles Darwin The only correct answer is A <i>B is incorrect because Robert Hooke did not write On the Origin of Species</i> <i>C is incorrect because Richard Leakey did not write On the Origin of Species</i> <i>D is incorrect because Gregor Mendel did not write On the Origin of Species</i>	(1) AO1 1

Question number	Answer	Mark
3 (a)(ii)	D new species evolve over many generations The only correct answer is D <i>A is incorrect because humans are related to other groups of animals</i> <i>B is incorrect because different species have different genes</i> <i>C is incorrect because dinosaurs did not evolve because of a meteor</i>	(1) AO1 1

Question number	Answer	Additional guidance	Mark
3 (b)(i)	the whale humerus is shorter / wider / stubbier	accept whale humerus is less likely to break / is stronger accept reverse arguments for humerus of human	(1) AO2 1

Question number	Answer	Additional guidance	Mark
3 (b)(ii)	the horse has fewer phalanges	the horse has 3 phalanges whereas the human has 14 phalanges accept humans have smaller phalanges / the horse phalanges are thicker / stronger accept reverse arguments for human	(1) AO2 1

Question number	Answer	Additional guidance	Mark
3 (c)	A description linking four from: - there was variation in beak shape / mutations occurred that changed the shape of the beak (in some finches) (1) - thinner beaks are more suited to catching / extracting {the food available for finch A /insects / finch A's environment} (1) - the birds with thinner beaks {outcompeted / were more successful than / more likely to survive / obtained more food } (those with thicker beaks) (1) (more) birds with thinner beaks reproduced and passed on alleles for thinner beaks (1) - this occurs over many generations / a long period of time (1)	accept reverse arguments	(4) AO2 1

Total marks for question 3 = 8 marks



Question number	Answer	Additional guidance	Mark
3(a)(i)	similar pattern of bones / 5 digits / pentadactyl (limb)		(1) AO3 1a

Question Number	Answer	Mark
3(a)(ii)	D Alfred Russel Wallace The only correct answer is D <i>A is not correct because Alexander Fleming did not work with Charles Darwin on the theory of evolution</i> <i>B is not correct because Gregor Mendel did not work with Charles Darwin on the theory of evolution</i> <i>C is not correct because Richard Leakey did not work with Charles Darwin on the theory of evolution</i>	(1) AO1 1

Question number	Answer	Additional guidance	Mark
3(b)(i)	(bones) contain (living) cells / nuclei / mitochondria	accept references to the role of DNA in bone cells	(1) AO2 1

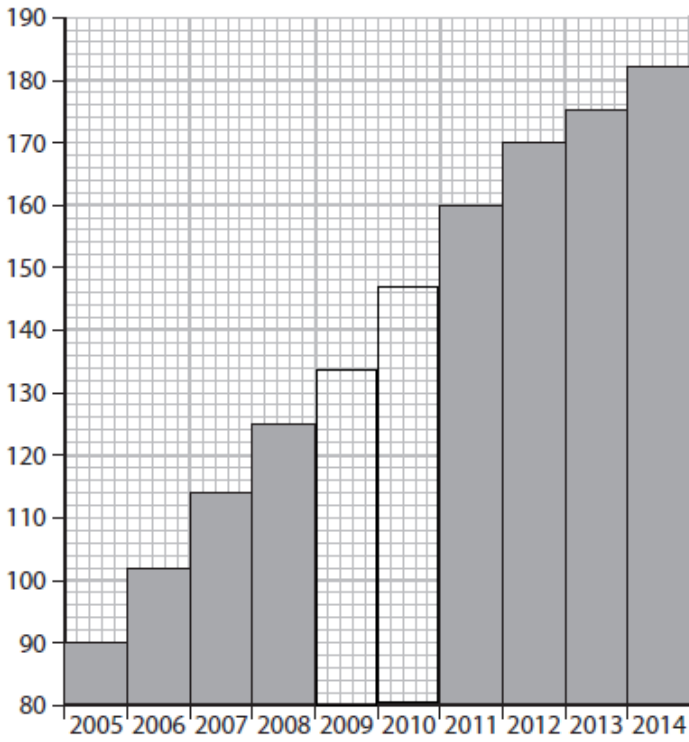
Question number	Answer	Mark
3(b)(ii)	An answer including two from: • (stem cells) divide / produce more cells (1) • by mitosis (1) • stem cells are undifferentiated (1) • (stem cells) differentiate / develop into {different / specialised} types of cells (1)	(2) AO1 1

Question number	Answer	Additional guidance	Mark
3(b)(iii)	cone(s) / rod(s)		(1) AO1 1

Question number	Answer	Mark
3(b)(iv)	An answer including • (transplanted stem cells) can develop / replace (retinal) cells (1) • to correct blindness / damaged retina (1)	(2) AO2 1

(Total for question 3 = 8 marks)



Question number	Answer	Mark																						
3(a)(i)	Bar for 2009 drawn correctly at 134 +/- half a small square (1) Bar for 2010 drawn correctly at 147 +/- half a small square (1)  <table><caption>Data from Bar Chart</caption><thead><tr><th>Year</th><th>Value</th></tr></thead><tbody><tr><td>2005</td><td>90</td></tr><tr><td>2006</td><td>102</td></tr><tr><td>2007</td><td>114</td></tr><tr><td>2008</td><td>125</td></tr><tr><td>2009</td><td>134</td></tr><tr><td>2010</td><td>147</td></tr><tr><td>2011</td><td>160</td></tr><tr><td>2012</td><td>170</td></tr><tr><td>2013</td><td>175</td></tr><tr><td>2014</td><td>182</td></tr></tbody></table>	Year	Value	2005	90	2006	102	2007	114	2008	125	2009	134	2010	147	2011	160	2012	170	2013	175	2014	182	(2)
Year	Value																							
2005	90																							
2006	102																							
2007	114																							
2008	125																							
2009	134																							
2010	147																							
2011	160																							
2012	170																							
2013	175																							
2014	182																							

Question number	Answer	Additional guidance	Mark
3(a)(ii)	A description including: • (gradual) increase (in area of land used) (between 2005 and 2014) (1) • the increase is less from 2012 (1)	accept other correct references to data	(2)

Question number	Answer	Mark
3(b)	(Larger yield means) less land is needed to grow GM crops	(1)

Question number	Answer	Mark
3(c)(i)	C biological control The only correct answer is C <i>A is not correct because using ladybirds is not an example of chemical control</i> <i>B is not correct because using ladybirds is not an example of enzyme technology</i> <i>D is not correct because using ladybirds is not an example of tissue culture</i>	(1)



Question number	Answer	Additional guidance	Mark
3(c)(ii)	An explanation linking two of the following: • reduces use of chemicals / pesticides (1) • so pests do not become resistant to insecticides / chemicals do not build up in the environment (1) OR • specific to the pest (1) • so other beneficial animals / insects are not affected (1)	accept cheaper (1) if explained (1)	(2)

Question number	Answer	Additional guidance	Mark
3(d)	risk of GM plants cross-pollinating with other plants / reduced biodiversity	accept creates 'super weeds' / consumers do not want GMOs	(1)

(Total for question 3 = 9 marks)

Question number	Answer	Mark
5(a)	lack of need to find a {mate / partner} / rapid reproductive cycle / plantlet has the same characteristics as the parent plant (so should be able to survive in that environment) / can quickly colonise an area.	(1) AO1 1

Question number	Answer	Additional guidance	Mark
5(b)(i)	A description including two from: - plantlets are not produced at 5°C / 10 °C / 30 °C (1) - the number of plantlets then increases up to 20 °C (1) - the number of plantlets decreases above 20 °C (1)	accept plantlets are produced between 15°C and 25°C accept 20 °C is the best temperature (for producing plantlets)	(2) AO3 1a 1b

Question number	Answer	Mark
5(b)(ii)	D grow five of these plants at each temperature The only correct answer is D <i>A is incorrect because a plant would not grow at 0° C</i> <i>B is incorrect because growing the plants in different soils would introduce a second variable</i> <i>C is incorrect because growing a different species of plant would introduce a second variable</i>	(1) AO3 3b

Question number	Answer	Additional guidance	Mark
5(c)	An explanation including two of: • inherit different alleles (1) • (which gives greater) variation in (species) / structures / characteristics / example of a characteristic (1) • (so) will be able to exploit / survive / grow in different {conditions / environments} (1)	accept gets DNA from different plants	(2) AO1 1

Question number	Answer	Additional guidance	Mark
5(d)	An explanation including three from: • select plants L and M (1) • because these have the desired alleles / the offspring will inherit the desired alleles (1) • L because of large white flowers and large leaves (1) • M because of striped leaves (1)		(3) AO3 2a 2b

(Total marks for question 5 = 9)



Question number	Answer	Mark
5(a)(i)	An answer including: • select large chickens /chicks from larger chickens (1) • breed together (1) • repeat over (many) generations / long period of time (1)	(3)

Question number	Answer	Mark
5(a)(ii)	Benefit • produces more food / fewer chickens needed for the same amount of meat (1) Risk • less variation /losing useful genes (from the gene pool) / losing traits which may be desirable in the future / health issues related to larger bodies (1)	(2)

Question number	Answer	Mark
5(b)(i)	39 / thirty-nine	(1)

Question number	Answer	Additional guidance	Mark
5(b)(ii)	meiosis / meiotic cell division	reject mitosis / mitotic cell division	(1)

Question number	Answer	Mark
5(c)(i)	C all the genetic material of an organism The only correct answer is C <i>A is not correct because a genome is not all the cells of an organism</i> <i>B is not correct because a genome is not all the enzymes of an organism</i> <i>D is not correct because a genome is not all the cytoplasm of an organism</i>	(1)

Question number	Answer	Mark
5(c)(ii)	Any two from: • identify useful genes (1) • track evolution/ identify new species to show which species are more closely related (1) • understand diseases (of crop plants and animals) (1) • discover new medicines / find a cure for diseases (1) • identify the sequences that allow some plants and animals to cope with environmental change (1)	(2)

(Total for question 5 = 10 marks)



Question number	Answer	Additional guidance	Mark
4(a)	A description including three from: • select birds with highest egg production (1) • breed (these birds) (1) • select / breed birds (with best traits) from these offspring (1) • repeat over many generations (1)	ignore select the best chickens accept offspring inherit genes for producing more eggs accept repeat over a long time	(3) AO2 1

Question number	Answer	Mark
4(b)(i)	D diploid The only correct answer is D <i>A is incorrect because chicken body cells are not dominant</i> <i>B is incorrect because chicken body cells are not haploid</i> <i>C is incorrect because chicken body cells are not recessive</i>	(1) AO1 1

Question number	Answer	Additional guidance	Mark
4(b)(ii)	39 / thirty nine		(1) AO2 1

Question number	Answer	Mark									
4(c)	<table border="1"> <thead> <tr> <th>type of cell produced</th><th>type of cell division</th><th>number of daughter cells produced</th></tr> </thead> <tbody> <tr> <td>body cell</td><td>mitosis</td><td>2 (1)</td></tr> <tr> <td>gamete</td><td>meiosis (1)</td><td>4 (1)</td></tr> </tbody> </table> Additional guidance Accept alternative spellings of meiosis. Reject if meiosis has a 't' in it.	type of cell produced	type of cell division	number of daughter cells produced	body cell	mitosis	2 (1)	gamete	meiosis (1)	4 (1)	(3) AO1
type of cell produced	type of cell division	number of daughter cells produced									
body cell	mitosis	2 (1)									
gamete	meiosis (1)	4 (1)									

Question number	Answer	Additional guidance	Mark
4(d)	A description including two from: - make (new) cells / divide (1) - differentiate / become specialised / become other (named) types of cell (1)	accept mitosis ignore stem cells are unspecialised / undifferentiated ignore repair cells accept repair	(2) AO1 1
	(provide new cells) {for growth / to replace (damaged) cells} (1)	damaged tissues / organs	

Total marks for question 4 = 10 marks



Question number	Answer	Additional guidance	Mark
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Question Number	Answer	additional guidance	Mark
10(a)(i)	differentiation (1)	accept specialisation	(1) AO 2 1

Question Number	Answer	additional guidance	Mark
10(a)(ii)	A logical description including two of the following: - many plants produced (1) - quicker than sexual reproduction (1) - genetically identical/ clones produced (1) - with the desired characteristics (1) - plants from endangered/rare plants (1)	accept gives more of that plant/higher yield of that plant ignore plants grow faster obtain plants difficult to grow from seed (1)	(2) AO 1 1

Question Number	Answer	Additional guidance	Mark
10(a)(iii)	Any two from: - sterilises agar growth medium (1) - destroys unwanted {bacteria /pathogens/fungi/microorganisms/viruses} /there is no contamination (1) - so microorganisms don't {affect growth of plantlets / don't compete with plantlets/ don't use nutrients needed by plantlets} (1)	ignore prevents microorganisms getting in accept only the plantlets grow	(2) AO 2 2

Question Number	Answer	Additional guidance	Mark
10(a)(iv)	mutation / disease	accept different alleles/ genotypes/genetic variation	(1) AO 2 1

Question Number	Answer	Additional guidance	Mark
10(b)(i)	An answer that provides a description by making reference to: - add iodine (solution) (1) - blue-black colour indicates presence of starch (1)		(2) AO 1 2

Question Number	Answer	Additional guidance	Mark
10(b)(ii)	- it is an insulator/reduces heat loss (1) - so energy from sugar is used to heat water / the result is more accurate (1)	accept stops water loss	(2) AO 2 2

Question Number	Answer	Additional guidance	Mark
10(b)(iii)	ensures heat is distributed (evenly) throughout the water (1)	accept all the water is at the same temperature	(1) AO 2 2

Total for Question 10 = 11 marks



Question Number	Answer	Mark
7(a)	A description including two from: • they have a similar arrangement of bones / five digits / pentadactyl limb (1) • evolved from a common ancestor (1) • adapted for different functions (1)	(2) AO1 1

Question Number	Answer	Mark
7(b)(i)	A biological control The only correct answer is A <i>B is not correct because this method of limiting the population of weeds is not chemical control</i> <i>C is not correct because this method of limiting the population of weeds is not tissue culture</i> <i>D is not correct because this method of limiting the population of weeds is not genetic engineering</i>	(1) AO2 1

Question Number	Answer	Mark
7(b)(ii)	Any two from: • (using insects is) safer than using {pesticides/chemicals} (1) • the insects used are specific to this weed (1) • insects do not need to be repeatedly reapplied (1) • cacti could become resistant to chemicals (1)	(2) AO2 1



Question Number	Indicative content	Mark
7(c)*	Advantages • less crop damage / spoilage • so higher yield • so more food for people • crop plants are less likely to have diseases that are spread by insects • so less pesticides / insecticides used • more profit • so more income for developing countries Disadvantages • concerns about the long-term effects (of genetically modified organisms) • ethical concerns / wrong to move genes between species • GM crops could contribute to the development of medical conditions in humans • GM crops could trigger allergic reactions • genes could be transferred to other species / weeds • so weeds could grow out of control / compete with crop plants • genetically modified seeds could be more expensive to buy • reliance of farmers on GM seed companies • reduced gene pool • insects will evolve so crops are no longer resistant to insect pests	(6) AO2 1



Level	Mark	• Descriptor •
	0	• No rewardable material.
Level 1	1-2	• The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question • Lines of reasoning are unsupported or unclear.
Level 2	3-4	• The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. • Lines of reasoning mostly supported through the application of relevant evidence.
Level 3	5-6	• The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. • Lines of reasoning are supported by sustained application of relevant evidence.

Level 1	1-2	• an advantage OR a disadvantage is identified • makes an attempt to explain the advantage / disadvantage
Level 2	3-4	• an advantage AND a disadvantage is identified OR • more than one advantage OR more than one disadvantage is identified • clearly explains one of the advantages OR clearly explains one of the disadvantages
Level 3	5-6	• more than one advantage AND more than one disadvantage is identified • clearly explains one of the advantages AND clearly explains one of the disadvantages

(Total for question 7 = 11 marks)



7(a)(i)	(cancer cells) divide uncontrollably / have mutations	accept {multiply / grow / reproduce} rapidly	(1) AO1 1
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Question number	Answer	Additional guidance	Mark
7(a)(ii)	cells in tissue culture may respond differently to cells in the body	accept the drug may not work the same / might produce different results	(1) AO2 1

Question number	Answer	Additional guidance	Mark
7(b)(i)	autoclave	accept use gamma (rays) / UV ignore heating / radiation	(1) AO1 1

Question number	Answer	Additional guidance	Mark
7(b)(ii)	An explanation linking: - to kill bacteria / pathogens (1) - so {plant cells / plantlets} can grow disease-free / growth of {plant cells / plantlets} is unaffected (1) - so {plant cells / plantlets} do not compete for resources (with pathogens) (1)	accept to prevent contamination / prevent growth of unwanted organisms ignore reduce the number of bacteria / pathogens accept so {plant cells / plantlets} are not damaged / killed (by pathogens) accept a named resource e.g. nutrients	(2) AO1 1

Question number	Answer	Additional guidance	Mark
7(b)(iii)	One from: (tissue culture) allows a {large number of / more} new plants to be produced (1) - only a small quantity of original plant tissue needed (1) - plants do not become extinct (1)	ignore references to yield / less space required / faster process accept genetic material is not lost accept can control environmental factors / can grow plants at any time of year (1) accept plants are easier to monitor (1)	(1) AO1 1

Question number	Indicative content	Mark
7(c)*	A01 <u>cell wall</u> • made of cellulose • tough • difficult for pathogens to break down / digest / gain entry <u>waxy cuticle</u> • protects epidermis and tissues below • difficult for pathogens to get through <u>thorns / prickles / spines</u> • deter herbivores from eating them <u>bark</u> • difficult for pathogens / pests to get through • protects living tissue beneath	(6) A01 1

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	- Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. - Presents a description with some structure and coherence.
Level 2	3-4	- Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. - Presents a description that has structure which is mostly clear, coherent and logical.
Level 3	5-6	- Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. - Presents a description that has a well-developed structure which is clear, coherent and logical.

Level	Mark	Additional Guidance	General additional guidance The level is determined by the number of physical barriers described. The mark within the level is determined by the level of detail in each description.
Level 1	1-2	- The answer refers to a physical barrier - The response includes a detail about a physical barrier	<u>Possible candidate response</u> - Some stems have thorns - Some stems have thorns, which stop animals eating the plant
Level 2	3-4	- The description refers to more than one physical barrier - The response includes some detail about a physical barrier	<u>Possible candidate response</u> Plant cells have a tough cell wall. Some stems have thorns.

			Plant cells have a tough cell wall that stops pathogens getting in. Some stems have thorns.
Level 3	5-6	- The description refers to several physical barriers - The response includes details of at least two physical barriers	<u>Possible candidate responses</u> - Leaves have a waxy cuticle. Plant cells have a cell wall. Trees have bark on the outside. - Leaves have a waxy cuticle on top. Plant cells have a cellulose cell wall. These stop pests piercing the plant. Trees have bark on the outside, which protects living tissue on the inside.

Total for Question 7 = 12 marks

