

PEARSON EDEXCEL A-LEVEL BIOLOGY B • 9B10

BIOLOGY



EXAM QUESTION PACK

TOPIC 10: ECOSYSTEMS

HUMAN EFFECTS ON ECOSYSTEMS

SCORE

/116

PERCENTAGE

%

STEMUP

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Q1.

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

The photograph shows a glacier that is melting. As the glacier gradually melts, it leaves behind bare rock.



(Source: © CHARLES D. WINTERS/SCIENCE PHOTO LIBRARY)

Scientists sampled the soil from areas that had been uncovered for different lengths of time after the glacier ice had melted.

The table shows the results from the samples.

Length of time since glacier melted / years	Soil depth / cm	Mass of nitrate in soil / mg m^{-2}	Mass of leaf litter that falls to ground each year / $\text{g m}^{-2} \text{yr}^{-1}$
5	5.2	3.8	1.5
15	6.4	4.1	1.7
40	7.0	5.3	12.8
100	9.2	21.8	277.0
150	10.8	35.4	335.0
200	15.1	53.3	277.0
250	16.2	61.4	261.0

Which of the following should be used to determine if there is an association between length of time since the glacial ice has melted and soil depth?

(1)

- ☒ **A** chi squared
- ☒ **B** correlation coefficient
- ☒ **C** standard deviation

(Total for question = 1 mark)

Q2. The carbon cycle describes the movement of carbon within an ecosystem.

In this cycle, carbon neutral processes do not change the concentration of carbon dioxide in the atmosphere.

The table below shows the main sources and combustion products of some fuels.

Fuel	Main sources	Main combustion products
Biodiesel	Oils from crops such as soya beans, rape seeds, palm seeds	Carbon dioxide and water vapour
Ethanol	Fermented sugars from crops such as sugar cane, sugar beet	Carbon dioxide and water vapour
Hydrogen	Catalysis of methane from fossil deposits or biogas generation using waste biomass	Water vapour
Methane	Extracted from fossil deposits or biogas generation using waste biomass	Carbon dioxide and water vapour
Propane	Refining of crude oil from fossil deposits	Carbon dioxide and water vapour

(a) Place a cross ☒ in the box next to the names of the four fuels, shown in the table, that could be considered to be biofuels.

(1)

- ☒ **A** biodiesel, ethanol, hydrogen, methane
- ☒ **B** biodiesel, ethanol, hydrogen, propane
- ☒ **C** biodiesel, ethanol, methane, propane
- ☒ **D** biodiesel, hydrogen, methane, propane

*(b) Large areas of land may need to be cleared in order to produce biofuels. This might involve deforestation.

Discuss why the production of biofuels may not be carbon neutral.

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(c) Explain how the combustion products, from the burning of fuels, may lead to global warming.

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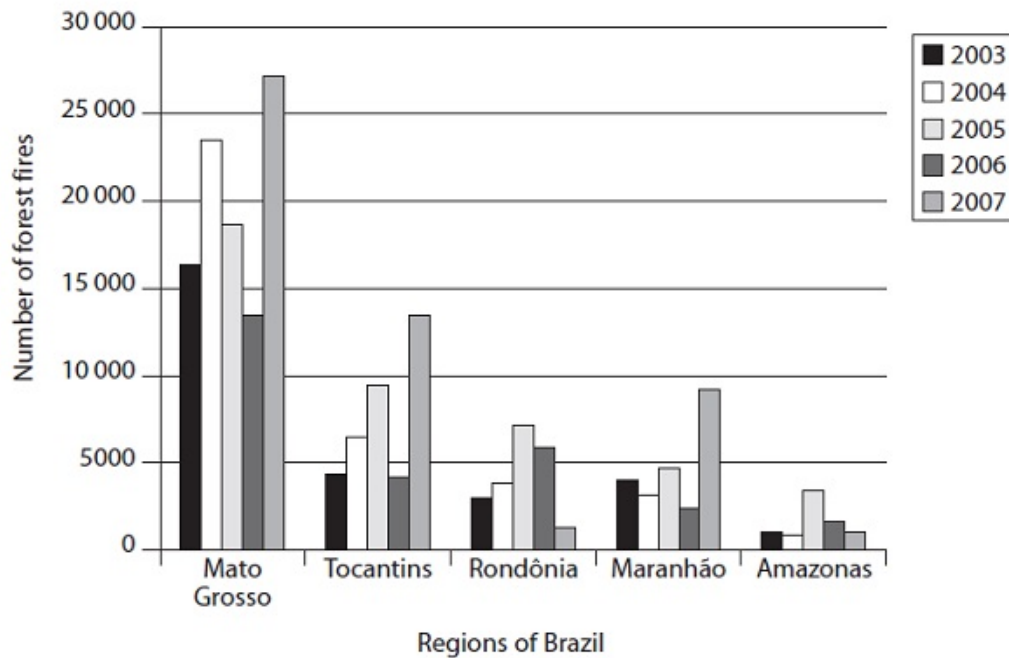
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(Total for Question = 10 marks)

Q3. Global warming is a worldwide problem that affects climate and the environment.

(a) The graph below shows the number of forest fires in five regions of Brazil, for 2003 to 2007.



(i) Place a cross ☒ in the box next to the best conclusion that can be drawn from these results about the number of forest fires in Brazil.

(1)

- ☒ **A** The number of forest fires has generally decreased
- ☒ **B** The number of forest fires has generally increased
- ☒ **C** The number of forest fires in Mato Grosso each year is always higher than in other areas
- ☒ **D** There are no clear trends

*(ii) Explain how forest fires may lead to global warming.

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(b) (i) Explain why the use of biofuels may help to reduce global warming.

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(ii) Explain **one** disadvantage of using biofuels to reduce global warming.

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(Total for Question = 11 marks)

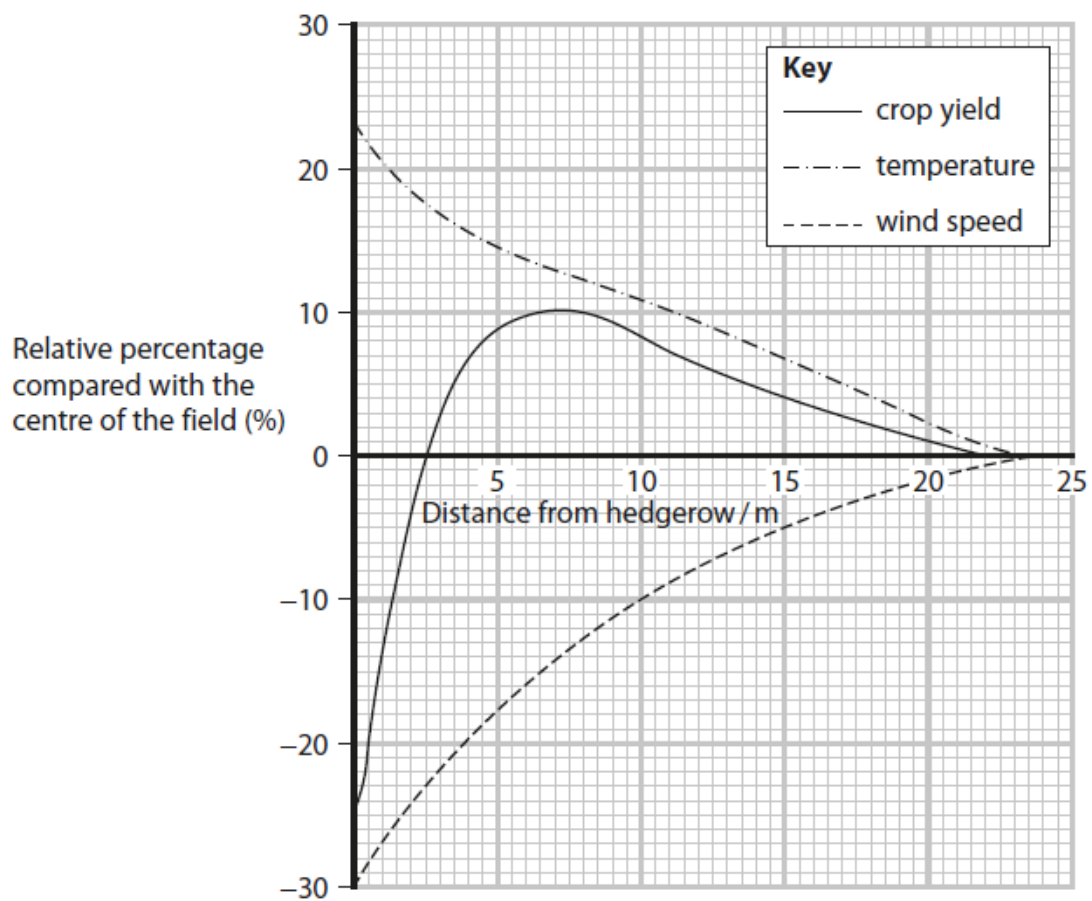
Q4.

* For many years, hedgerows have been removed to increase field sizes to grow crop plants.

Hedgerows provide a habitat for many species of plants and animals.

Some animals that live in hedgerows eat pests of crops and some pollinate crop plants.

The crop yield, temperature and wind speed were measured across the field starting at the hedge. These factors and the crop yield are shown as a relative percentage compared with the centre of the field in the graph.



Analyse the information to comment on the value of conserving hedges around fields used for growing crops.

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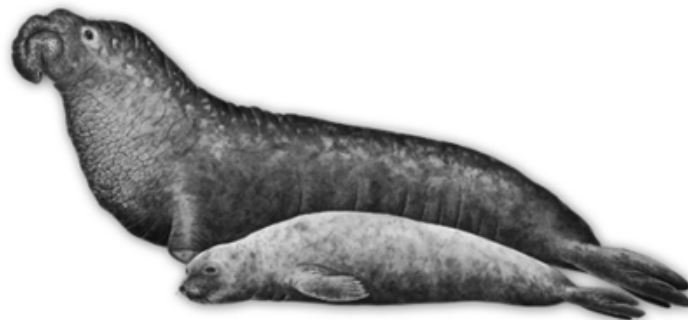
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(Total for question = 6 marks)

Q5.

The Northern elephant seal is a mammal found in the Eastern Pacific Ocean.



In the nineteenth century, Northern elephant seals were hunted and this reduced the population to about 20 seals.

The seals were listed as an Appendix II species when CITES was established in the 1970s.

The population has now recovered to over 100 000 individuals.

The seals in this population have developed health problems, including a high mortality rate for newborn pups, deformities and weak immune systems.

(i) Describe the role of treaties such as CITES in maintaining global biodiversity.

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(ii) Explain why, although the population of seals has recovered, many of the seals have health problems.

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(Total for question = 4 marks)

Q6.

* The photograph shows a tawny owl. These owls live in areas close to the Arctic Circle.



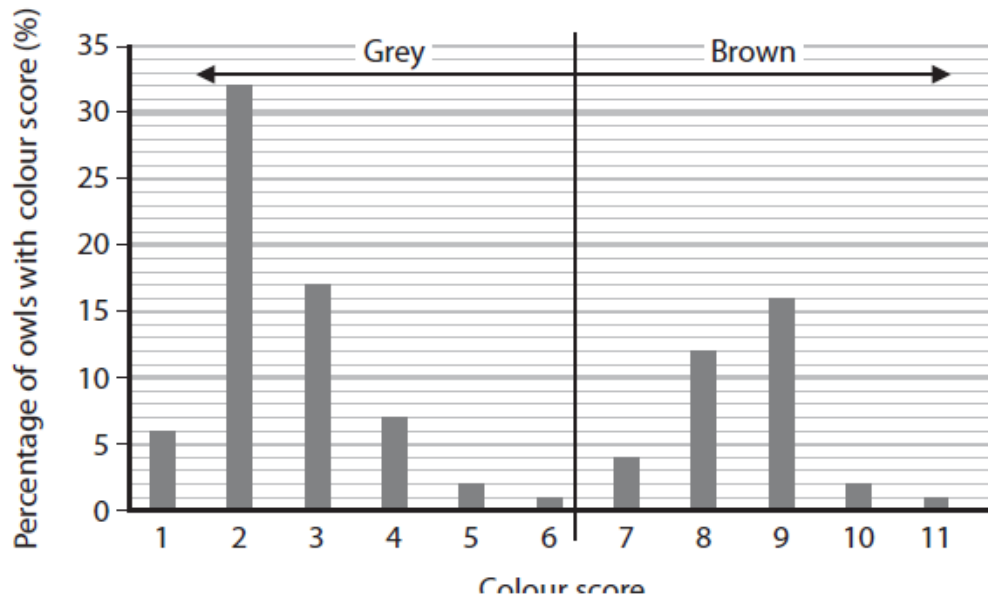
(Source: © LINDA WRIGHT/SCIENCE PHOTO LIBRARY)

Scientists investigated the feather colours of a population of tawny owls. Feather colours of the owls were scored on a scale of 1 to 11, according to how grey or brown they were.

Grey feathered owls were given a score between 6 and 1, with 1 being the most grey.

Brown feathered owls were given a score between 7 and 11, with 11 being the most brown.

The graph shows the percentages of owls in the population with each of the colour scores.



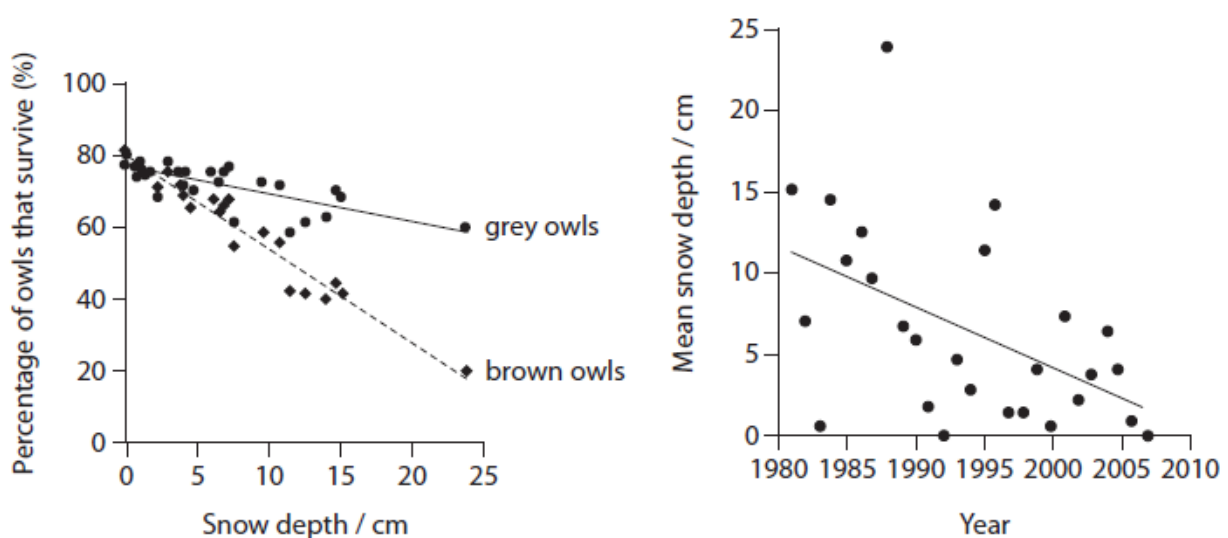
The scientists investigated the effect of climate change on the frequencies of these two alleles for feather colour in populations of tawny owls.

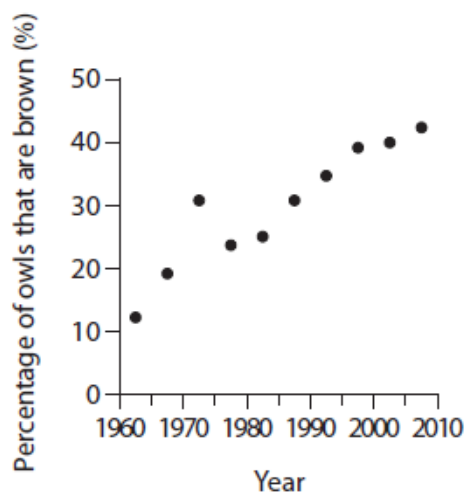
The percentage survival rates of both colours of owl were measured when there were different depths of snow.

The mean depth of snow was recorded each year between 1980 and 2007.

The percentage of owls that were coloured brown between 1960 and 2007 was also recorded.

The graphs show the results.





The scientists concluded that increased greenhouse gases from human activity are resulting in an increase in the frequency of the brown allele.

Analyse the data to evaluate this conclusion.

(6)

[illegible]

(Total for question = 6 marks)

Q7.

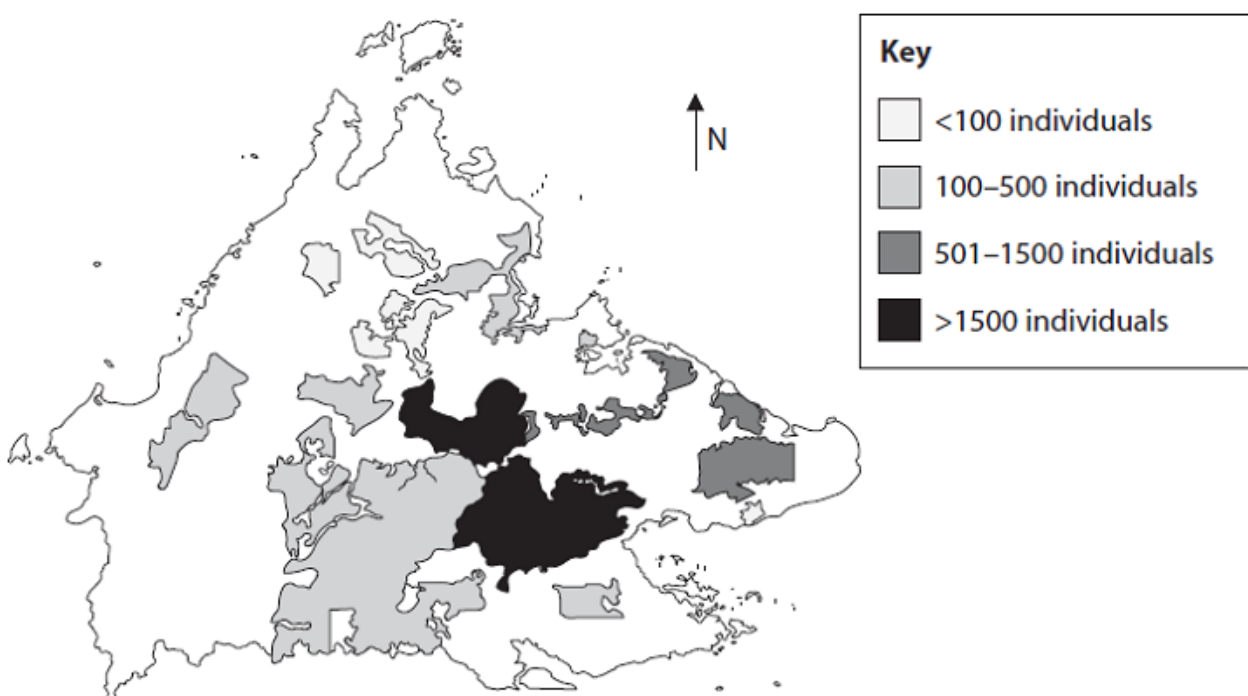
Palm plants and cocoa plants are used to produce lipids for the food industry.

Palm oil is produced from palm plants. Cocoa butter is produced from cocoa plants.

Some forests in Borneo have been cleared to grow these plants.

Orangutans used to live in forests throughout this island but now they are found in small areas of forest.

The map shows the distribution of orangutans in parts of Borneo.



(i) Explain why in areas with low populations of orangutans, many of the orangutans have deformities and health problems.

(2)

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(ii) The Malaysian government is paying local people to create and maintain 'land-bridges' of forest to link areas of forest together.

Explain why these payments will help to develop palm oil production and support conservation of orangutans.

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(iii) State how treaties such as CITES help conserve orangutans.

(1)

(Total for question = 6 marks)

Q8.

(i) Describe and explain how global warming could affect plant species.

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(ii) Explain how the effects on plant species could affect animal species.

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Q9.

Of the five rhino species, Javan rhinos (*Rhinoceros sondaicus*) are the most in threat of extinction, with as few as 35 individuals surviving in Ujung Kulon National Park in Java, Indonesia.

This national park is highly vulnerable to tsunamis and volcanic activity. In Java, large areas have been planted with *Arenga pinnata*, which is a source of palm oil. This plant has now colonised 50% of this national park.



© topimages/shutterstock

(a) Give **one** biotic factor which contributes to *Rhinoceros sondaicus* becoming a critically endangered species.

(1)

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(b) Explain why a species may become endangered when its population falls to a very low number.

(2)

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Conservationists are working with the national park in order to conserve the Javan rhino.

Give **two** methods that could be used to conserve the Javan rhino.

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Q10.

In Kenya, an in-situ conservation project has been set up to make paper from elephant dung.

This project aims to help conserve elephant populations, conserve biodiversity and help local communities.

Elephant conservation often involves the setting up of protected areas to stop poaching. Local people are banned from entering these areas.

This method of elephant conservation sometimes causes conflict with local people, as elephants can trample and eat crops in nearby farmland. Farmers sometimes burn areas of grassland and forest to stop elephants destroying their farmland.

The new paper conservation project encourages local people to make paper from elephant dung they collect from the conservation area. The paper they make is sold at a high price.

Conservationists measured the effect of the new paper project on the index of diversity of the area over two years. They also measured the effect of a protected conservation area where local people were banned from entering on the index of diversity. The results are shown in the table.

Area	Index of diversity	
	At start of project	After two years
Conservation area with paper project	2.8	3.6
Conservation area where local people are banned from entering	2.4	2.2

(i) State why calculating an index of diversity is a better measure of biodiversity than counting the number of different species.

(1)

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(ii) Give two advantages of in-situ conservation of elephants compared with ex-situ conservation of elephants.

(2)

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(iii) Explain the effect of the new paper project on biodiversity compared with the protected area where local people were banned.

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(Total for question = 7 marks)

Q11.

In Kenya, an in-situ conservation project has been set up to make paper from elephant dung.

This project aims to help conserve elephant populations, conserve biodiversity and help local communities.

Describe the limitations of CITES in the conservation of organisms such as elephants.

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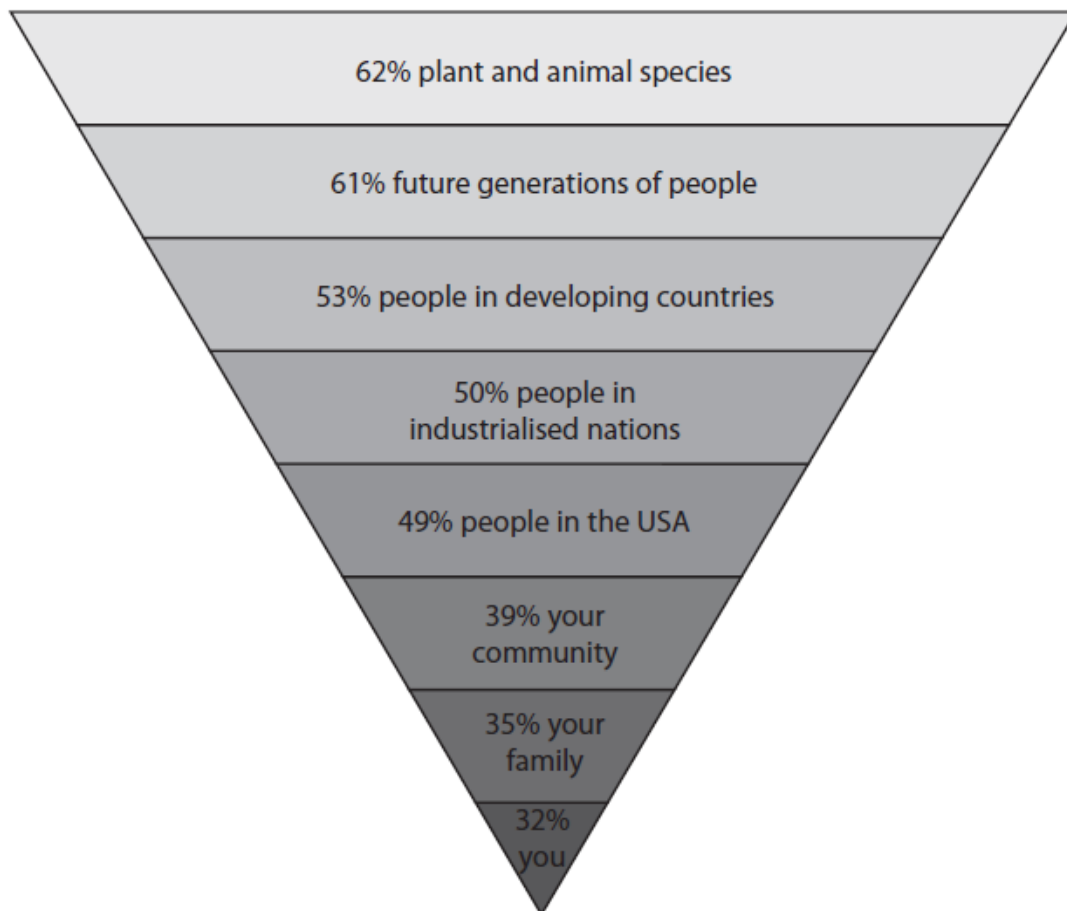
(Total for question = 2 marks)

Q12.

A survey was conducted in the USA to find out what harm people thought global warming could have.

The people were asked if they thought global warming could harm the eight groups shown in the diagram.

The diagram below shows the percentage of people who thought each group would be harmed.



Explain the meaning of the term **global warming**.

(2)

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Q13.

Chester Zoo has 10 black rhinoceros. The black rhinoceros is critically endangered due to being hunted for its horns.

One kilogram of rhinoceros horn can sell for more than £50 000.

The photograph shows a black rhinoceros.



The number of black rhinoceros fell from 70 000 in 1960 to 15 000 in the late 1970s.

All trade in black rhinoceros horn was prohibited under CITES in 1977.

However, hunting continued and fewer than 2 500 black rhinoceros were left by the year 2000.

(i) Explain why hunting continued after the black rhinoceros was listed in CITES.

(2)

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(ii) Explain why the genetic diversity of the black rhinoceros has decreased between 1960 and 2000.

(2)

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Q14.

Gilbert's potoroo is one of the most critically endangered species in the world.

Gilbert's potoroo was thought to be extinct until one was found in 1994.

It is thought that there are only 70 individuals.

The photograph shows a potoroo and its pouched baby feeding on berries.



The map shows the only part of Australia where Gilbert's potoroo is found.



In 1994, there were only 20 Gilbert's potoroo individuals, 12 of which were in a captive colony.

A captive breeding programme was set up using:

- four adult females and one young female
- one adult male, two young males and one young male still in its mother's pouch.

(i) Explain why allele frequencies may cause problems in this population of potoroos.

(3)

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(ii) Foxes and feral cats, which are predators of potoroos, were introduced into Australia by settlers.

The photograph shows a feral cat with its prey.



The Australian government is using poisoned sausages in an attempt to kill 2 million feral cats by 2020.

The sausages contain chunks of kangaroo meat combined with chicken fat, herbs, spices and a poison.

The content of the sausages was based on flavours irresistible to cats.

The poison used is produced by the Swan River pea plant that is found in Western Australia. Other Australian plants that contain the poison are: *Acacia*, *Wedge Peas* and *Nemcia*.

This poison is a natural toxin that biodegrades rapidly and the native wildlife in Australia has evolved natural resistance to it.

A group of 160 000 people in Australia have signed a petition against the plan to poison feral cats.

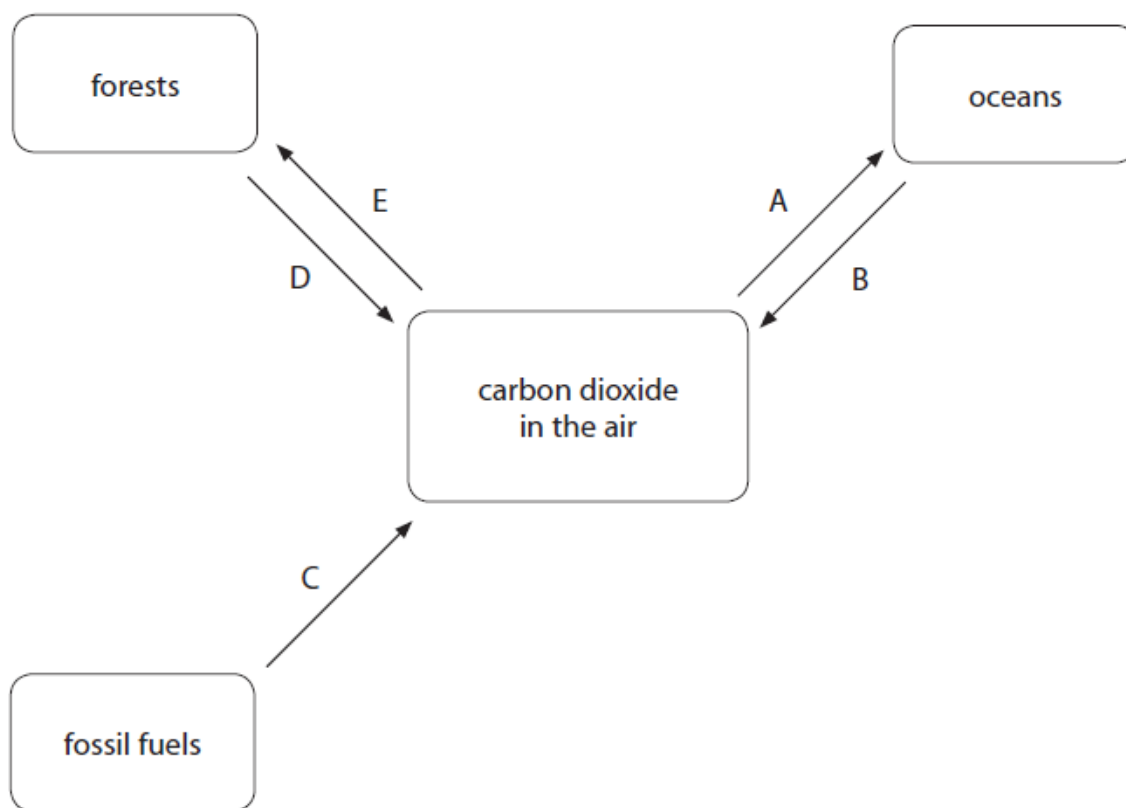
Discuss whether the plan to poison feral cats is justified.

(9)

(Total for question = 12 marks)

Q15.

The diagram below shows part of the carbon cycle. The processes A, B, C, D and E, transfer carbon.



Place a cross ☒ in the box next to the gases produced by process C.

(1)

- ☒ **A** carbon dioxide and methane
- ☒ **B** carbon dioxide and water vapour
- ☒ **C** carbon dioxide, methane and water vapour
- ☒ **D** carbon dioxide, oxygen and water vapour

Q16.

The table shows information about one area of the North Atlantic Ocean.

Month	Mean hours of daylight / hr	Mean monthly temperature / °C	Net primary productivity (NPP) / g carbon m ⁻² day ⁻¹
January	9.0	2.8	-1.0
February	10.0	3.1	-1.2
March	11.0	6.7	-0.5
April	13.0	9.4	+3.0
May	14.0	15.5	+4.0
June	15.0	20.6	+8.0
July	14.0	23.9	+7.0
August	13.5	23.3	+7.0
September	12.0	21.1	+5.0
October	11.0	16.1	+4.0
November	10.0	11.1	+3.0
December	9.0	4.0	-1.2

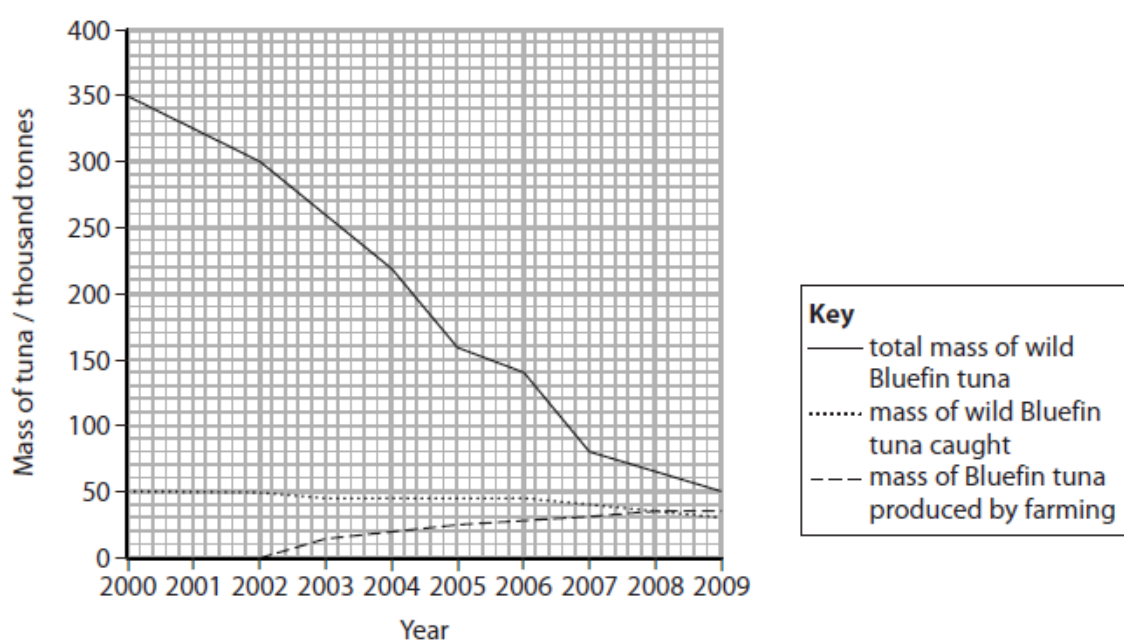
Bluefin tuna are the top predators in this ocean.

Bluefin tuna are caught by the fishing industry for human consumption. The demand is very high.

One method to help meet the demand for Bluefin tuna is tuna farming.

This method traps young sexually immature fish from the wild. They are placed in submerged cages and fed on a diet of prey species captured from the ocean.

The graph shows the masses of wild Bluefin tuna caught and Bluefin tuna produced by farming. It also shows the total mass of wild Bluefin tuna in an area of the North Atlantic Ocean.



Comment on the impact of Bluefin tuna farming.

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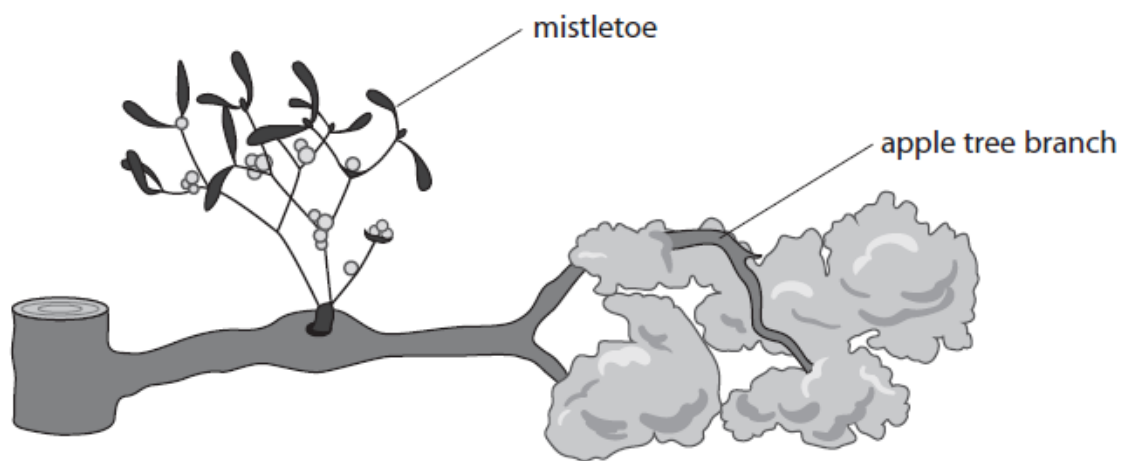
(Total for question = 4 marks)

Q17.

*Mistletoe is a plant that is a parasite on trees.

Mistletoe has green leaves. Mistletoe also has a modified root that grows into the xylem of a tree.

The diagram shows mistletoe growing on an apple tree branch.



The effect of mistletoe on the growth of apple trees was investigated.

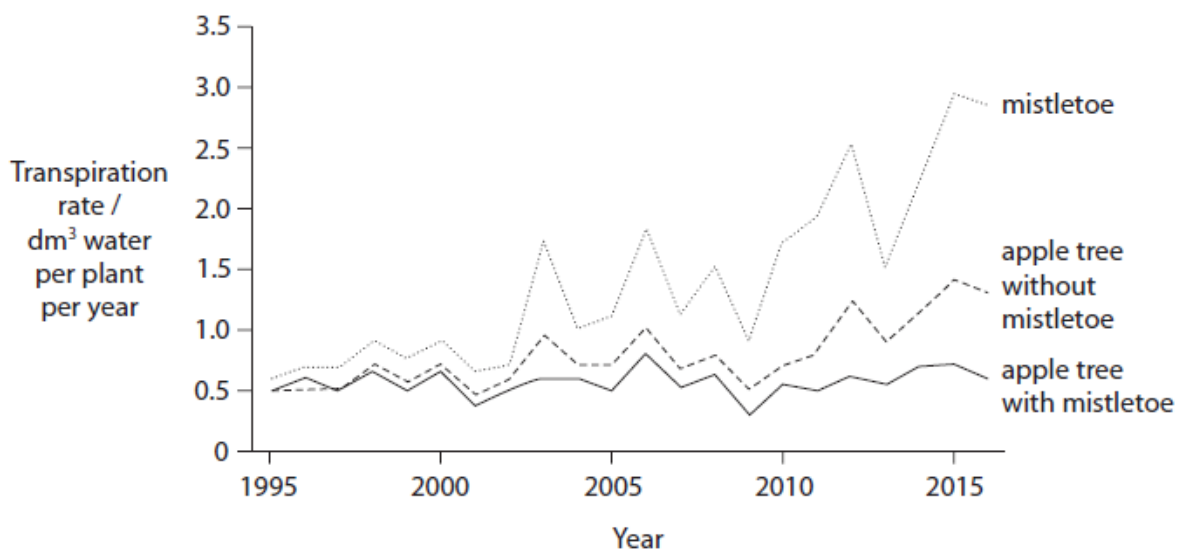
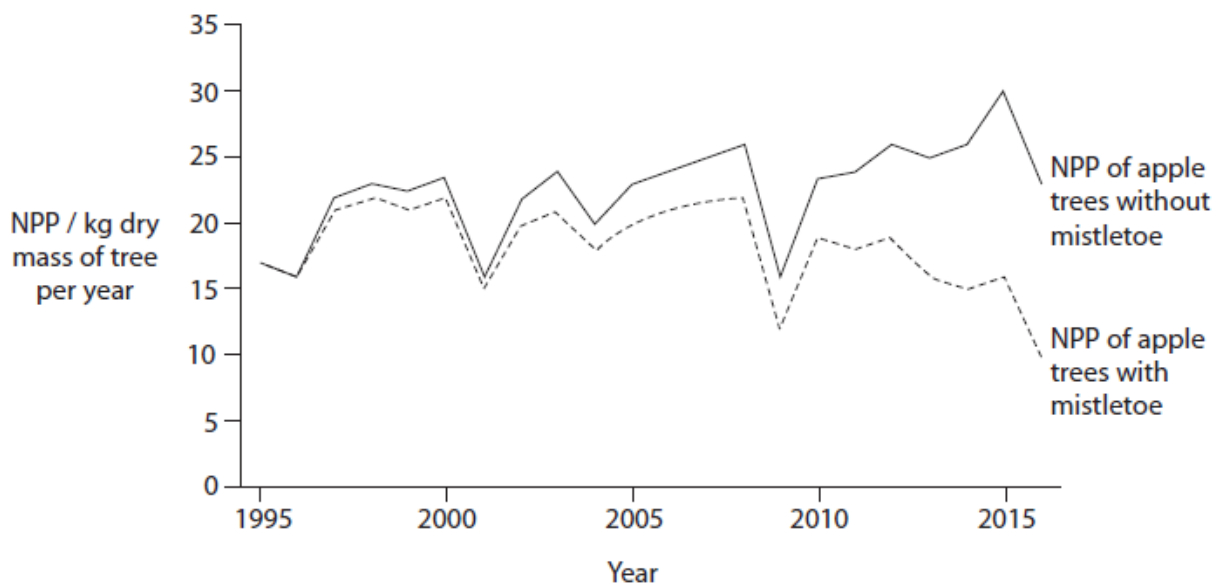
Every year for 20 years, scientists selected apple trees infected with mistletoe and measured the:

- mean net primary productivity (NPP) of the apple trees
- transpiration rate of the apple trees
- transpiration rate of the mistletoe branches on the apple trees

They also determined the mineral content of the apple tree leaves after 20 years.

A control group of apple trees not infected with mistletoe was included in this investigation.

The graphs and table show the results of the investigation.



Apple tree leaves from	Nitrogen content / mg per g of leaf	Calcium content / mg per g of leaf
trees infected with mistletoe	8.50	6.45
trees not infected with mistletoe	10.60	8.90

[illegible]

(Total for question = 6 marks)

Q18.

Frogs are ectothermic animals. This means that their body temperature will vary as the environmental temperature varies.

(a) Explain why body temperature affects the rate of development of animals.

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(b) Several species of the frog genus, *Rana*, can be found in North America. Many of these species inhabit areas within a range of latitudes from the colder north to the warmer south.

The table below shows data for four of these species, *R. clamitans*, *R. palustris*, *R. pipiens* and *R. sylvatica*.

Species	Body temperature of frog / °C			
	Lower lethal, below which frog dies	Minimum to start development	Maximum to complete development	Upper lethal, above which frog dies
<i>R. clamitans</i>	10.0	11.0	35.0	37.0
<i>R. palustris</i>	5.0	7.0	30.0	31.0
<i>R. pipiens</i>	3.0	6.0	28.0	30.0
<i>R. sylvatica</i>	0.0	2.0	24.0	25.0

Using the information, suggest why the lower and upper lethal temperatures limit the range of latitudes inhabited by each species of frog.

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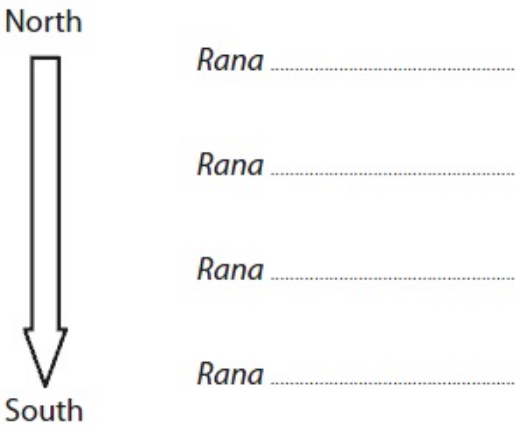
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(c) Complete the species names in the diagram below to show the most likely distribution of *Rana* from north to south.

(2)



(d) Populations of the different species overlap on the boundaries of each latitude range. Suggest why interbreeding does not take place between these populations.

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(e) Suggest how global warming may affect the distribution of these species of *Rana* in North America.

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(Total for question = 13 marks)

Q19.

Grassland is an important habitat for grazing animals such as cattle.

* When grazing animals such as cattle, sheep and horses are kept in fields, their faeces are left on the ground, and are known as dung.

The dung is eaten by dung beetles, which in turn are eaten by other animals.

Dung beetles bury dung up to one metre underground in tunnels they have made. This removes the dung from the surface of the field.

A cow can produce over eight tonnes of dung per year.

There are around 60 species of dung beetle in the UK. In 2016, 50% of these were identified as being scarce or threatened.

The photograph shows a dung beetle.



(Source: © Simon Webster/Alamy Stock Photo)

Scientists believe factors causing the decline of dung beetles include:

- farmers using more land to grow crops, and using more land for building and development
- keeping some grazing animals in sheds over the winter, rather than them spending the

winter in fields

- fewer habitats for dung beetles, leading to populations of dung beetles becoming isolated and preventing outbreeding
- grazing animals routinely being treated with anti-parasitic drugs that can kill dung beetles.

Some scientists have stated that farming practices need to change to conserve the species of dung beetle, and to maintain biodiversity and the stability of ecosystems.

Discuss the validity of this statement.

(Total for question = 9 marks)

Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
	<i>The only correct answer is:</i> B correlation coefficient <i>A is incorrect because chi squared compares frequencies</i> <i>C is incorrect as standard deviation is a measure of dispersion</i> <i>D is incorrect as t-test compares mean values</i>		1 comp

Q2.

Question Number	Answer	Additional Guidance	Mark
(a)	A ;		(1)

Question Number	Answer	Additional Guidance	Mark
*(b)	QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence - idea that biofuel production may (overall) results in more carbon dioxide in the atmosphere ; OR idea that carbon neutral means that the carbon dioxide produced equals the carbon dioxide used ; - idea of forests as carbon {sinks / eq} ; - idea that {clearing land / deforestation} results in (net) increase in carbon dioxide (in atmosphere) ; {less plants means} less carbon dioxide {removed / used / eq} by photosynthesis ; {burning / eq} trees produces carbon dioxide ; - idea that (increased) decomposition produces carbon dioxide; - idea of using {(fossil) fuels / petrol / diesel} by {lorries / machinery / eq} produces carbon dioxide ; {burning /eq} of biofuels produces carbon dioxide ;	QWC emphasis is clarity of expression Accept stores / sumps	(5)

Question Number	Answer	Additional Guidance	Mark
(c)	- reference to production of {greenhouse gases / named greenhouse gas} ; - idea that these gases {build up/ remain / form a layer} in (upper) atmosphere; - which {absorb / trap / eq} {heat energy / infra-red / IR / eq} ; - reflected from earth's surface ; - idea that increased levels of these gases increase the greenhouse effect ; - idea that (mean) temperature of earth's {surface / atmosphere} is increasing ;	Accept carbon dioxide, water vapour, sulphur dioxide, oxides of nitrogen Not methane Accept long wavelength light	(4)

Q3.

Question Number	Answer	Additional Guidance	Mark
(a)(i)	C ; The number of fires in Mato Grosso each year is always higher than other areas ;		(1)

Question Number	Answer	Additional Guidance	Mark
* (a)(ii)	(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence - reference to {fires / burning / eq} produces carbon dioxide ; - which is a greenhouse gas ; - idea that these gases {build up / remain / form a layer / increase} in (upper) atmosphere ; - which {absorb / trap / eq} {heat energy / infra red / IR / eq} ; - reflected from earth's surface ; - idea that increased levels of these gases increase the greenhouse effect ; - idea that (mean) temperature of earth's {surface / atmosphere} is increasing ; - idea that less carbon dioxide {removed / used / eq} by photosynthesis ;	QWC emphasis clarity of expression 1. Accept carbon dioxide, water vapour, sulphur dioxide, oxides of nitrogen Not methane 2. NB do not penalise ref to methane twice 4. Accept long wavelength light	(5)

Question Number	Answer	Additional Guidance	Mark
(b)(i)	- reference to biofuels being (possibly)carbon neutral ; - idea that {plants / crops} are used for biofuels ; - idea that carbon dioxide used for photosynthesis (by plants / in production of biofuels) ; - idea of using biofuels to replace fossil fuels ;	Ignore carbon unqualified 1. Accept idea of no (net) change in carbon dioxide levels in atmosphere	(3)

Question Number	Indicative content	
*	Answers will be credited according to candidate's deployment of knowledge and understanding of material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. Descriptions • crop yield is highest between 5 m and 10 m from hedgerow D • crop yield is lowest next to the hedgerow / crop yield is lower than the centre of the field upto 2.5 m • crop yield increases up to between 5 m and 10 m from the hedge and then decreases D • wind speed is lowest by the hedge D • wind speed increases with distance from the hedge D • temperature is higher by hedgerow / falls with distance D • hedgerows can increase crop yields, but fields need to be smaller D • hedgerows can take up land that could be used to grow crops D Abiotic Explanations • humidity is higher by the hedgerow A • reduced wind speed (by the hedge) increases the temperature A • transpiration / water loss / evaporation will be lower around hedgerow A • hedgerow acts as a wind break A • less than 2m from hedgerow productivity is lower due to competition / shading reducing photosynthesis A • between 5m and 15 m, higher temperature will increase	6

		photosynthesis rate A • higher temperature is closer to optimal enzyme temperatures A • wind can affect crops pollinated by wind A Biotic Explanations • pollinating species and predators increase productivity B • predators consume herbivores / pests B • pollinators are essential for seeded crops / example B • hedgerow may compete for nutrients / water / light B • less need for pesticides to be used when predator species live in hedgerows B	
Level	Marks		
Level 0	Marks	No awardable content	
Level 1	1-2	Limited scientific judgement made with a focus on mainly just one method, with a few strengths/weaknesses identified. A conclusion may be attempted, demonstrating isolated elements of biological knowledge and understanding but with limited evidence to support the judgement being made. Descriptions of factors one mark: any two from D two marks: three from D	
Level 2	3-4	A scientific judgement is made through the application of relevant evidence, with strengths and weaknesses of each method identified. A conclusion is made, demonstrating linkages to elements of biological knowledge and understanding, with occasional evidence to support the judgement being made. Descriptions and explanations three marks: any four points from D, A or B four marks: any five points from D, A or B and	

Level 3	5-6	A scientific judgement is made which is supported throughout by sustained application of relevant evidence from the analysis and interpretation of the scientific information. A conclusion is made, demonstrating sustained linkages to biological knowledge and understanding with evidence to support the judgement being made. Detailed explanation of all factors and how use of hedges can be beneficial Descriptions and explanations five marks: any six points from D, A and B six marks: any seven points from D, A and B	
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Q5.

Question Number	Answer	Additional Guidance	Mark
(i)	A description that makes reference to two of the following: • CITES prevents {exploitation / hunting / sale / trade / poaching} (1) • by countries that sign up to the treaty (1) • by {protecting / conserving} endangered species (1)		(2)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to two of the following: • (genetic / population) bottleneck (1) • causing reduced {genetic diversity / gene pool / number of different alleles} (in populations) (1) • therefore the chance of inheriting two harmful recessive alleles increases (1)	Accept small / restricted gene pool	(2)

Q6.

Question Number	Indicative content
*	Answers will be credited according to candidate's deployment of knowledge and understanding of material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. • with increasing snow depth, there is higher survival of grey owls / fewer brown owls survive / more grey owls D • snow depth has decreased over time D • the percentage of brown owls has increased over time / percentage of grey owls has decreased D For • with less snow, more ground is visible / uncovered / more twigs and trees visible E • with less snow, grey owls more obvious (to predators / prey) / less camouflaged E • with less snow, natural selection would favour brown owls / more brown (advantageous) alleles passed on / fewer grey alleles passed on / brown owls outcompete grey owls E • enhanced greenhouse effect due to carbon dioxide emissions reflecting radiation back / absorbing radiation (causing melting) E Against • no direct measure of greenhouse gas / temperature / fossil fuel emissions A • graphs show correlations not causal links A • data for owl survival with snow depth is scattered / gaps in data / weak correlation A • data for mean snow depth has many outliers / anomalies / not all points are around line / data is scattered A • other factors (named factors) could be affecting the owl population A • reduced snow may not be due to greenhouse gas release A

	• data for owl survival with snow depth is scattered / gaps in data / weak correlation A • data for mean snow depth has many outliers / anomalies / not all points are around line / data is scattered A • other factors (named factors) could be affecting the owl population A • reduced snow may not be due to greenhouse gas release A
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Level 0	Marks	No awardable content
Level 1	1-2 (1-3)	Limited scientific judgement made with a focus on mainly just one method, with a few strengths/weaknesses identified. A conclusion may be attempted, demonstrating isolated elements of biological knowledge and understanding but with limited evidence to support the judgement being made 1 mark : any 1 from D, E, A 2 marks : any 2 from D, E, A
Level 2	3-4 (4-6)	A scientific judgement is made through the application of relevant evidence, with strengths and weaknesses of each method identified. A conclusion is made, demonstrating linkages to elements of biological knowledge and understanding, with occasional evidence to support the judgement being made. D and, E OR A 3 marks : at least 3 points. Any combination of D, plus E, or A 4 marks : at least 4 points. Any combination of D, plus E, or A
Level 3	5-6 (7-9)	A scientific judgement is made which is supported throughout by sustained application of relevant evidence from the analysis and interpretation of the scientific information. A conclusion is made, demonstrating sustained linkages to biological knowledge and understanding with evidence to support the judgement being made. D, E, AND A 5 marks : at least 5 points. Must have combination of D, E, and A 6 marks : at least 6 points. Must have combination of D, E, and A

Q7.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to two from the following: - a genetic bottleneck has occurred (1) - resulting in a smaller gene pool (1) - so the probability of receiving two recessive alleles is higher (1)	Accept lower genetic diversity Accept inbreeding / higher chance of two organisms have similar alleles	2

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to three from the following: - therefore animals from different populations can move across territories / forest to forest (1) - therefore increasing genetic diversity / widens gene pool / increased allele number (1) - and balances the needs of local people with conservation / retains jobs for local people (1) - local people are more likely to maintain the bridges (1)	Accept animals from different forests can move in / more outbreeding	3

Question Number	Answer	Additional Guidance	Mark
(iii)	An answer that makes reference to one from the following: {banning export / import trade of species} preventing {poaching / illegal trapping} (1)	Accept {countries} sign treaty / agree preventing {poaching / trapping / exports / imports / trade}	1

Q8.

Question Number	Answer	Additional Guidance	Mark
(i)	Effects on plants: { loss / eq } of (existing) species / extinction ; - idea of changes in distribution (of plants / species) ; - idea of changes in {numbers / size / growth / eq } (of plants / species) ; Explanations (max 3): - idea that there will be changes in rainfall patterns ; - idea of a change in growing seasons ; - idea that temperature may become too hot for some species OR credit a link made between temperature and enzyme activity ; - idea of increased carbon dioxide results in more {photosynthesis / GPP / NPP / biomass / eq} ; - idea of fall in pH in {oceans / rivers / eq} ;	NB any link to an affect must be correct 4 ACCEPT droughts 5 ACCEPT flowering times	(4)

Question Number	Answer	Additional Guidance	Mark
(ii)	- idea of reduction of {herbivore / primary consumer} ; - idea that this would result in a reduction of {predator / secondary consumer / tertiary consumers} ; - idea that a change in {distribution / numbers / types / eq} of plants could result in a change in distribution of {herbivores / eq} ; - idea of loss of {habitat / eq} decreasing {breeding rate / numbers / eq} ; - idea of loss of {shelter / camouflage / eq} provides more food for predators so they would increase in {size / number} ;	ACCEPT converse for increase in plant {number / size / eq} 1 ACCEPT idea of loss of animals because of reduction in food supply 2 ACCEPT idea of loss of animals that feed on the herbivores 4 ACCEPT named example e.g. nesting place	(3)

Q9.

Question Number	Correct Answer	Additional guidance	Mark
(a)	An answer that makes reference to one of the following: - poached by humans for their horn (1) <i>Arenga pinnata</i> outcompetes the food source/less food for rhino (1) - disease (1)		(1)

Question Number	Correct Answer	Additional guidance	Mark
(b)	An explanation that makes reference to two of the following: - difficulty in finding mates (1) - so population growth is affected (1) or - loss of genetic diversity / small gene pool (1) - so less resistance to environmental change (1)		(2)

Question Number	Correct Answer	Additional guidance	Mark
(c)	An answer that makes a reference to two of the following: - habitat maintenance / restoration / clearing <i>Arenga pinnata</i> (1) - locate breeding sites for reproduction (1) - protect the rhinos from poachers (1) - ensuring that the food source is maintained/plant more food source (1) - breeding programme outside of national park (1)		(2)

Q10.

Question Number	Answer	Additional Guidance	Mark
(i)	(index of diversity) takes into account populations (of each species) (1)	Accept considers abundance / number of each species Accept because an area could have many different species but different populations	1 exp

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to two from the following points: - other species are also conserved (in the ecosystem) (1) - animals are not humanised / behaviours are natural / no change to behaviour (1) - less inbreeding occurs (1)	Accept converse for <i>in situ</i> Accept other species are protected / food webs are maintained / maintains biodiversity / maintains links in ecosystem Accept more space for animals Accept no need to transport animals Accept less inbreeding depression / maintain gene pool	2 grad

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation that makes reference the following points: - biodiversity has increased (in the paper project area) more (than the protected area) (1) - as less / no grassland is burnt / less poaching (1) (more) niches are available / habitats are not destroyed / elephants transfer plant seeds (1) - local people make money from the paper project / if the elephants are not present, local people lose a source of income (1)	Accept biodiversity has increased but {did not increase / went down} in area where people are banned Accept grassland burning / poaching still occurs in unprotected area Accept converse for protected area Accept converse for protected area Accept people have a vested interest in the elephants / make a profit	4 exp

Q11.

Question Number	Answer	Additional Guidance	Mark
	A description that makes reference to two of the following points: - not all countries sign the treaty / signing the treaty is voluntary (1) - many species move across national boundaries (1) - monitoring is expensive / some countries are too large to monitor / high financial rewards for {poaching / smuggling} / CITES (only) prevents trade (1)	Accept the treaty is not legally binding (within nations) Accept some species migrate / have very large ranges Accept not all species are classed as endangered Accept countries may not be able to monitor within their borders Accept some poaching will continue	2 exp

Q12.

Question Number	Answer	Additional Guidance	Mark
	1. (gradual) increase in {average / eq } temperature ; 2. (of earth's) {surface / atmosphere} (and oceans) ;	NB IGNORE any explanations as to the cause 1 IGNORE warming	(2)

Q13.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to the following: • high value of horn incentivised hunters to break the law (1) • because trade ban led to black market and increase in price of horn (1) OR • demand for horn remained high (1)		

	- because CITES did not help to educate consumers / increasing disposable income in consuming nations / used for traditional medicine in some cultures (1) OR - ineffective enforcement (1) - because large areas of habitat are difficult to police / lack of resources available for enforcement / high value of horn funding bribery or corruption (1)		(2)
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Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: - fewer alleles in the gene pool due to smaller number of individuals (1) - greater frequency of homozygous genotypes due to mating of related individuals (1)		(2)

Q14.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to three of the following: - the numbers are very small causing a genetic bottle neck (1) - so that variation in the gene pool may have been reduced (1) - causing increased likelihood of inbreeding effects (1) - such as accumulation of disadvantageous mutations (1)	Allow reference to founder effect Allow small gene pool Allow inbreeding depression, Allow early offspring may have come from only one male Allow greater chance of receiving two recessive alleles	(3)

(ii)

Level	Marks	
0	0	No awardable content
1	1-3	Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made. Vague statements related to consequences are made with limited linkage to a range of scientific ideas, processes, techniques and procedures. The discussion will contain basic information with some attempt made to link knowledge and understanding to the given context.
2	4-6	Demonstrates adequate knowledge and understanding by selecting and applying some relevant biological facts/concepts. Consequences are discussed which are occasionally supported through linkage to a range of scientific ideas, processes, techniques and procedures. The discussion shows some linkages and lines of scientific reasoning with some structure.
3	7-9	Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts. Consequences are discussed which are supported throughout by sustained linkage to a range of scientific ideas, processes, techniques or procedures. The discussion shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.

ii Applying marking points These are indicative marking points and other relevant information should be credited Level 1 1 mark: any point 2 marks: any two points 3 marks: any 3 points Level 2 4 marks: 4 points, must have + and - 5 marks: 5 points, must have + and - 6 marks: 6 points, must have + and - Level 3 Points must come	Justification for using poison to kill feral cats 1. less potoroos killed (+) 2. potoroos less likely to become extinct (+) 3. feral cats are an introduced species (+) 4. there are very large numbers of feral cats (+) 5. increased fungal spread in ecosystem (by potoroos) (+) 6. introduced species will be killed but native species unharmed (+) 7. biodiversity remains higher if native species not killed (+) 8. sausages are designed to target cats (+) 9. native species less likely to become extinct (+) 10. poison is biodegradable (+) Reasons not to kill feral cats with poison 1. pets may be killed (-) 2. other animals may be killed (-) 3. lots of people object to this (petition) (-) 4. sausages could be attractive to wild species as well (-) 5. government could use other methods to reduce population of feral cats (-) 6. suggested other methods eg spaying, shooting (-) 7. killing cats does not deal with threat from foxes (-) 8. plants / kangaroos are killed to make the poison (-) 9. feral cats are behaving naturally and should not be punished for this (-)
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from all three sections 7 marks: 7 points, must have + and - 8 marks: 8 points, must have + and - 9 marks: 9 points, must have + and -	Wider points 1. poison made from native plants so less likely to kill native animals (+) 2. biodegradable poison so action now will not affect animals in the future (+) 3. potoroos require special protection as there are such small numbers / endangered (+) 4. idea of balance needed in ecosystem (+) 5. cats have no natural predators in Australia, so it is justified to kill them (+) 6. ethics of government choosing which species to kill (-) 7. government could continue the breeding programme for potoroos (-) 8. effect on food chain of killing 2m feral cats (positive or negative) 9. feral cats may develop resistance to the poison (-) 10. government could try a small-scale trial to find effects of cull (-)
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Q15.

Question Number	Answer	Additional Guidance	Mark
	B carbon dioxide and water		(1)

Q16.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to four of the following: • mass of wild tuna decreases more steeply (after 2002) (1) • there is a decrease in (wild tuna) caught after 2002 (1) • because farming takes {immature / young} from the wild population that have not reproduced / so breeding of tuna is reduced (1) • farming reduces food available for the wild population (reducing population) (1) • farming has not replaced the catch of wild tuna / consumer demand has risen (1)	ACCEPT idea of bigger increase after fish farming started ACCEPT total of caught + farmed has increased	(4)

Q17.

Question Number	Indicative content
*	Answers will be credited according to candidate's deployment of knowledge and understanding of material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. • mistletoe lowers the NPP of apple trees over time (D) • NPP of trees without mistletoe shows an upward trend over 20 years (D) • NPP of trees with mistletoe shows an downward trend over 20 years (D) • mistletoe decreases the transpiration rate of the trees (D) • mistletoe has a higher transpiration rate than the apple tree (D) • higher transpiration rate of mistletoe diverts transpiration stream to mistletoe rather than apple tree / mistletoe takes the water from apple tree (E) • so less minerals are given to the apple tree (E) • less water for photosynthesis (E) • nitrogen content of apple trees is lower (D) • less amino acid / protein synthesis occurs (E) • less enzyme production so less photosynthesis (E) • lowering NPP (due to less enzymes) (E) • less nucleic acid synthesis (E) • less chlorophyll synthesis (E) • calcium content of the apple trees is lower (D) • so there is less production of cell walls / calcium pectate (E) Level 1: one or two D or E Level 2: three or four from both D and E Level 3: five or six from both D and E, must explain effect of either low nitrogen / calcium and have no major errors

Level	Marks	
Level	Marks	
0	0	No awardable content
1	1-2	An explanation may be attempted but with limited interpretation or analysis of the scientific information with a focus on mainly just one piece of scientific information. The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context.
2	3-4	An explanation will be given with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows some linkages and lines of scientific reasoning with some structure.
3	5-6	An explanation is made which is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.

Q18.

Question Number	Answer	Additional guidance	Mark
(a)	- reference to increase in {metabolic rate / enzyme activity / eq} as temperature rises ; - reference to increase in {kinetic / eq} energy of molecules (as temperature rises) / eq ; - reference to increase in {enzyme-substrate complexes / energy of collisions / eq} (as temperature rises) ; - idea of {inactivation at lower temperatures/ denaturation at higher temperatures} of enzymes ; - idea that temperature affects {differentiation / growth /division / eq} ;	1. Accept converse argument for mp 1 – 3 2. Accept movement 4. Accept the idea that enzyme-substrate complexes cannot be made if denaturing	(3)

Question Number	Answer	Additional guidance	Mark
(b)	- idea that temperature affects {survival / development / growth / metabolism / cell division / eq} ; - idea that enzymes affect {development / growth / metabolism / cell division/ eq} ; - idea that temperature affects enzymes ; - idea that different frogs have different enzymes ;		(2)

Question Number	Answer	Additional guidance	Mark
(c)	<i>sylvatica,</i> <i>pipiens,</i> <i>palustris,</i> <i>clamitans</i> ; ;	if order correct but reversed = 1 mark	(2)

Question Number	Answer	Additional guidance	Mark
(d)	1. idea that different species are reproductively isolated ; 2. idea of different breeding {times / seasons / eq} ; 3. idea of different {breeding / courtship / eq} {behaviour / rituals / displays / colour / songs / croaks / eq} ; 4. idea that population at {northerly / southerly} limit of range may not develop (to adulthood) ; 5. idea that breeding between different species results in infertile offspring ;	3. Accept idea of incompatible {genitalia / gametes}	(3)

Question Number	Answer	Additional guidance	Mark
(e)	1. idea that global warming will increase the temperature (at the latitudes) ; 2. idea that temperatures (at these latitudes) may become too high for any of the species ; 3. idea that new temperature may be above the maximum to complete development or above the upper lethal limit ; 4. idea that species move {north / to cooler regions / eq} ; 5. ref to change in {food source / predators / competition / eq} ;	2.Accept become extinct	(3)

Q19.

Question Number	Answer	Additional Guidance	Mark
	Level 1: links information given to effect on dung beetles as below (up to 3 points from anywhere) Level 2: links information given to effect on dung beetles as below (up to 3 points from one category and up to 3 points from either one or two other categories) Level 3: links information given to effect on dung beetles as below (up to 3 points from one category and up to 3 points from each of the other 2 categories) No credit for points quoted from information given without qualification Indicative content Threats to dung beetles (T points) • (less grazing animals on land) so less dung available ie reduced food source • (farmland used for building / development) so reduced habitat • (animals kept in sheds overwinter) so food source unreliable / not constant • (routine use of anti-parasitic drugs) so drugs in animal faeces which kill dung beetles • (isolated populations of dung beetles) so genetic diversity is reduced • (isolated populations of dung beetles) - small populations of dung beetle species have a small gene pool, so allele frequencies can change rapidly • (many) dung beetles feed specifically on the dung of particular species, so reduction in species of grazing animals decreases diversity		
	Benefits of dung beetles (B points) • (remove dung from fields) so more access for grazing by animals • (remove dung from fields) so less chance of parasites living in dung and reinfesting cattle • (bury dung underground) so decomposers can break it down • decomposition of dung is faster if dung beetles are present • (decomposed dung) increases mineral content of soil • (eaten by birds etc) so provide food for other animals / loss of dung beetles could lead to collapse of food chains Wider points and consequences to farming (W points) • climate change may be having an effect on decline eg rise in temperatures, changed rainfall patterns • if farming practices change animals will suffer • if farming practices change, less economically viable to farm • if farming practices change, less food produced • adding fertilisers disrupts dung beetle life cycle • ploughing pasture disrupts dung beetle life cycle • small populations much more vulnerable to disease • pesticides may affect other animals in food chain: accumulation • (digging tunnels) improves soil structure by aeration • dung beetles may be involved in seed dispersal (seeds in faeces being moved around by beetles) • (routine use of anti-parasitic drugs) kill other beneficial invertebrates (as well as dung beetles) • No evidence or stats to prove or disprove • A new predator might be responsible for decline • Parasite numbers would increase if treatment stops • Cattle contribute to global warming, so better not to farm cattle • Urbanisation might be causing change, not farming practices		

Benefits of dung beetles (B points)

- (remove dung from fields) so more access for grazing by animals
- (remove dung from fields) so less chance of parasites living in dung and re-infecting cattle
- (bury dung underground) so decomposers can break it down
- decomposition of dung is faster if dung beetles are present
- (decomposed dung) increases mineral content of soil
- (eaten by birds etc) so provide food for other animals / loss of dung beetles could lead to collapse of food chains

Wider points and consequences to farming (W points)

- climate change may be having an effect on decline eg rise in temperatures, changed rainfall patterns
- if farming practices change animals will suffer
- if farming practices change, less economically viable to farm
- if farming practices change, less food produced
- adding fertilisers disrupts dung beetle life cycle
- ploughing pasture disrupts dung beetle life cycle
- small populations much more vulnerable to disease
- pesticides may affect other animals in food chain: accumulation
- (digging tunnels) improves soil structure by aeration
- dung beetles may be involved in seed dispersal (seeds in faeces being moved around by beetles)
- (routine use of anti-parasitic drugs) kill other beneficial invertebrates (as well as dung beetles)
- No evidence or stats to prove or disprove
- A new predator might be responsible for decline
- Parasite numbers would increase if treatment stops
- Cattle contribute to global warming, so better not to farm cattle
- Urbanisation might be causing change, not farming practices