Adaptations, competition and human impact on the environment

124 minutes

124 marks
Q1. There are two forms of peppered moth, dark and pale. Birds eat the moths when the moths are resting on tree bark.

Pollution in the atmosphere may:
- kill lichens living on tree bark
- make the bark of trees go black.

(a) Draw a ring around the correct answer to complete the sentence.

Lichens are very sensitive to air pollution caused by

- carbon dioxide.
- nitrogen.
- sulfur dioxide.

(b) The photographs show the two forms of peppered moth, on tree bark.

(i) The dark form of the peppered moth was produced by a change in the genetic material of a pale moth.

Use **one** word from the box to complete the sentence.

<table>
<thead>
<tr>
<th>characteristic</th>
<th>clone</th>
<th>mutation</th>
</tr>
</thead>
</table>

A change in genetic material is called a ...............................................................
(ii) In the 19th century, pollution made the bark of many trees go black. Explain why:

- the population of the pale form of the moth in forests decreased
- the population of the dark form of the moth in forests increased.

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(c) (i) The larvae (young) of the peppered moths eat the leaves of birch trees. The diagram shows the food chain:

birch trees → peppered moth larvae → birds

Draw a pyramid of biomass for this food chain. Label the pyramid.
(ii) Which two reasons explain the shape of the pyramid you drew in part (c)(i)?

Tick (✓) two boxes.

Some material is lost in waste from the birds

The trees are much larger than peppered moth larvae

Peppered moth larvae do not eat all the leaves from the trees

The trees do not use all of the Sun’s energy

(2)
(Total 9 marks)

Q2. The drawings show a humming bird and a sun bird feeding.
Both of these birds feed on nectar which is a sugary liquid found inside flowers.

Use the information from the drawings to answer the following questions.

(a) Describe, as fully as you can, how the humming bird is adapted for feeding on nectar.
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(2)

(b) The sun bird has a different method of obtaining nectar.

Describe, as fully as you can, how the sun bird is adapted for feeding on nectar.

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(2)

(Total 4 marks)

Q3. In just a decade the population of the African elephant dropped from 1.3 million in 1979 to 625,000 in 1989. The ivory trade was a major cause of this. The international trade in ivory was banned in 1989 in an attempt to arrest the fall in elephant numbers. The ban does not, however, have universal support, particularly amongst African countries. The extracts below give some opinions about the ban on killing elephants.

**Extract 1**
Massive publicity for the plight of the elephant in the US and Europe resulted in people refusing to buy ivory products. As a result the world price of ivory fell. Poaching levels fell noticeably in five out of six countries studied since the introduction of the ban.

**Extract 2**
If the case for wildlife is justified on economic grounds alone, then protected areas could give way to many more profitable forms of land use. Wildlife, and especially an animal as intelligent as the elephant, has an absolute right to life and a value that cannot be measured solely in economic terms.
Extract 3
South African governments consider wildlife a natural resource which must earn its keep alongside other competing forms of land use both by bringing in tourists and from the killing of excess animals for food and other animal products. Zimbabwe for example keeps elephant numbers to a level which can be supported by the vegetation available. Before the ban, ivory and hide were exported to gain valuable foreign currency. The planned use of wildlife for the benefit of local people and as a means of conservation for elephants is of great importance in that country.

Extract 4
Banning the trade in ivory, these countries argue, removes one of the main economic justifications for giving over large areas of land to wildlife and has resulted in heavy financial losses for those countries which conserve elephants. These countries are asking that they should again be allowed to trade in ivory and hides to provide the funding to conserve elephants.

Extract 5
Arguments about the need to preserve elephants for their intelligence or for their appearance carry little weight in a rural population faced with widespread famine. In the long run it appears that African wildlife will have to benefit those who live alongside it, and pay its way if governments are to invest in it.

Read the extracts then state whether you think that the ban on ivory and hide trading should be lifted. Justify your decision by referring to all the extracts. (Total 7 marks)
The lynx is a wild cat which lives in Canada. The table shows the number of lynx trapped in a part of Canada in certain years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of lynx in thousands</th>
</tr>
</thead>
<tbody>
<tr>
<td>1918</td>
<td>45</td>
</tr>
<tr>
<td>1920</td>
<td>25</td>
</tr>
<tr>
<td>1922</td>
<td>10</td>
</tr>
<tr>
<td>1924</td>
<td>20</td>
</tr>
<tr>
<td>1926</td>
<td>40</td>
</tr>
<tr>
<td>1928</td>
<td>50</td>
</tr>
</tbody>
</table>

The snowshoe hare is another wild animal found in Canada. The graph shows the number of snowshoe hares trapped in the same years. The lynx eats the snowshoe hare.

(a) Draw a graph of the data in the table. The first two points have been plotted for you.

(b) From your graph, predict how many lynx were trapped in 1925.

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(1)
(c) Use the information to answer the following.

(i) What would you expect to happen to the number of lynx trapped in 1930? Draw a ring around your answer.

rise \hspace{1cm} fall \hspace{1cm} stay the same

(1)

(ii) Give a reason for your answer to part (c)(i).

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(1)

(d) The lynx is a predator. What is a predator?

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(1)

(Total 6 marks)

Q5. Emperor penguins have adaptations that help them to survive in very cold antarctic conditions.

![Oily feathers, Streamlined body, Layer of fat under the skin]

Emperor penguins catch fish in the sea.
Use this information and information from the drawing to explain how the Emperor penguin is adapted to survive in the antarctic.

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(Total 3 marks)

Q6.

Two students were surveying dandelions in a field. They noticed that the dandelions by the hedge were taller than the others.

One student suggested that the differences in height could have been caused by the different conditions in the field.

(a) (i) Was he correct? ............................................

Give reasons for your answer.
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(2)
(ii) Explain how you could test to see if his answer was correct.

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(b) The hedge was cut down and removed.

What would happen to the height of the dandelions after some time?

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Explain your answer. ..................................................................................................
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(Total 6 marks)

Q7. Copper compounds are found in water that has drained through ash from power stations.

Invertebrate animals are used to monitor the concentration of copper compounds in water. First,
scientists must find out which invertebrate animals can survive in a range of concentrations of
copper compounds.

This is how the procedure is carried out.

• Solutions of different concentrations of a copper compound are prepared.
• Batches of fifty of each of five different invertebrate species, A, B, C, D and E, are placed
  in separate containers of each solution.
• After a while, the number of each type of invertebrate which survive at each concentration
  is counted.

(a) Give two variables that should be controlled in this investigation so that the results are
valid.

1 ..................................................................................................................................
2 ..................................................................................................................................

(2)
(b) The graph below shows the results for species B.

Use the graph to find the concentration of copper compounds in which 50% of Species B survived. To obtain full marks you must show clearly on the graph how you obtained your answer.

Concentration ......................... parts per million

(2)

(c) The graph below shows the results of the tests on the other four invertebrate species.
(i) Which species, A, C, D or E, is most sensitive to the concentration of copper in the water?

Give the reason for your answer.

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(1)

(ii) It is often more convenient to use invertebrates rather than a chemical test to monitor water for copper.

Suggest one explanation for this.

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(2)

(Total 7 marks)

Q8. The drawings show two different species of butterfly.

- Both species can be eaten by most birds.
- *Amauris* has a foul taste which birds do not like, so birds have learned not to prey on it.
- *Hypolimnas* does not have a foul taste but most birds do not prey on it.

(a) Suggest why most birds do not prey on *Hypolimnas*.

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(2)
(b) Suggest an explanation, in terms of natural selection, for the markings on the wings of Hypolimnas.

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(3)
(Total 5 marks)
The drawings and text for this question are based on an article from The Independent newspaper.

Some of Britain’s rarest wild flowers are likely to make a come-back thanks to an EC set-aside regime in which 15 per cent of arable land has been taken out of production.

As a result of this set-aside, shepherd’s needle, pheasant’s eye, corn gromwell, corn cockle, spreading hedge parsley and corn mouse tail are now thriving once again. They were once common in and around cereal fields and were even regarded as weeds, but were swept to near extinction by the intensification of agriculture after the Second World War. Their small, pale flowers are hardly seen. These plants cannot compete in fields where modern cereal crops are cultivated. Nor, however, do they flourish in semi-natural or wild habitats where nature is left to its own devices. They need farmland which is lightly tilled and cut once a year.

Dr Nick Sotherton, lowland research manager with the Game Conservancy Council, says that these species will flourish under the new rotational set-aside regime, in which farmers are compensated for taking land out of production in an attempt to end crop surpluses.

EC agriculture ministers are meeting to decide how much land should be used for rotational set-aside – in which a field is taken out of production for just one year before being replanted – and how much should be set-aside permanently. The ultimate set-aside is a wood, and Britain is seeking a forestry option.

The Game Conservancy Council says that the rotational scheme can benefit ground nesting birds as well as rare flowers that will not be helped by longer-term set-aside. But Richard Knight of the Wildlife Advisory Group, says “Non-rotational is better because it gives flora and fauna a chance to get well established”.

“Intensification of agriculture” has led to the creation of artificial ecosystems.

(a) Explain how the creation of artificial ecosystems may have led to the near-extinction of the plants seen in the picture above.

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(b) What would you recommend to ministers meeting to decide a policy involving rotational set-aside and permanent set-aside? Explain the reasons for your answer.

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(Total 8 marks)

##

Whitefly are pests and harm plants in glasshouses. A small wasp can be used to control the whitefly.

The wasp can only lay its eggs in the larvae of whiteflies. The wasp larva eats the body of the whitefly larva. It then changes into a new wasp and flies off.

(a) Choose words from the list to complete the sentences below.

decomposer       predator       prey       producer

The wasp larva feeds on the whitefly larva.

The wasp is a .............................................

The whitefly is known as the wasp’s .............................................

(2)
(b) The graph shows how the numbers of whitefly and wasps change over several months.

What happens to the number of wasps between 15 and 20 months?

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Why do you think this happens?

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(4)

(c) What would happen to the wasps if there were no larvae in which to lay their eggs?

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(1)

(Total 7 marks)
The gemsbok is a large herbivore that lives in herds in desert areas of South Africa. Gemsboks feed on plants that are adapted to living in dry conditions. There are not many rivers, lakes or ponds that can provide drinking water for the animals. The desert areas are hot during the day but cool at night.

(a) A few lions live in the desert areas. They hunt and feed on the gemsboks.

Use information from the photograph of the gemsbok to suggest and explain two ways in which the gemsbok could avoid being killed by lions.

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2. ....................................................................................................................
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   (2)
The graphs show the water content of the desert grass and the percentage of gemsboks feeding at different times of day.

(i) Suggest why the percentage water content of the grass decreases between 7.00 and 18.00.
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(ii) Between which times of day are more than 25% of the herd feeding?
............................................. and ..............................................

(1)
(iii) Explain one advantage to the gemsbok of feeding mainly at these times.

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(2)

(c) Although the gemsbok lives in hot conditions, it does not sweat. During the day its body temperature can rise, but it is important that blood reaching the brain does not rise above 40 °C.

The diagram shows how the gemsbok's blood system is adapted to cool the blood that flows to the brain.

(i) Suggest an advantage to the gemsbok of not sweating.

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(1)

(ii) Suggest how the blood is cooled in the cavities of the nose.

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(2)
(iii) Suggest how the structure of the rete helps in keeping the brain cool.

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(2)

(Total 11 marks)

Q12. Students investigated the distribution of two plant species near a busy road. The bar chart shows their results.

![Bar chart showing plant distribution](chart.png)

Key: □ Plantain □ White deadnettle

(a) (i) Name the piece of apparatus used in sampling a 1m² piece of land.

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(iii) Describe the pattern shown in the data for the Plantain plants.

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(1)

(b) Suggest explanations for:

(i) the distribution of the White deadnettle plants

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(2)

(ii) the distribution of the Plantain plants.

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(2)

(Total 8 marks)
Q13. Lichens are sensitive to the amount of sulfur dioxide in the atmosphere. They are used as indicator species for the amount of air pollution. Air pollution is generally higher in town centres than in the countryside.

Students investigated the relationship between lichen species and distance from a town centre.

- On a map, they drew a transect (line) from the centre of the town to the countryside.
- They examined sites every 200 metres along the transect (line).
- At each site, they recorded the lichen species growing on trees and walls up to a height of 2 metres.

The graph shows their results.

The lines on the graph indicate the range of each lichen species.

(a) Give one way in which the students could have obtained more accurate results.

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(b) (i) Which lichen species was found over the greatest range?

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................................................

(b) (ii) Which lichen species grows only in the least polluted air?

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................................................
(c) One student concluded ‘You can tell how much sulfur dioxide there is in the air by the amount of *Lecanora* growing’.

Give **two** reasons why this is **not** a valid conclusion.

1 ............................................................................................................................................................

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2 ............................................................................................................................................................

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(2)  
(Total 5 marks)
An animal's feet are adapted to the animal's way of life.

The photographs show the feet of four different animals.

Draw a line from each photograph of feet to the correct adaptation.

<table>
<thead>
<tr>
<th>Photograph</th>
<th>Adaptation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Running very fast</td>
</tr>
<tr>
<td></td>
<td>Swimming</td>
</tr>
<tr>
<td></td>
<td>Flying</td>
</tr>
<tr>
<td></td>
<td>Catching and holding prey</td>
</tr>
<tr>
<td></td>
<td>Supporting a very heavy body</td>
</tr>
</tbody>
</table>

(Total 4 marks)

Feet, from top to bottom - By eek the cat [CC BY-ND 2.0], via Flickr. By France64160 (Own work) [GFDL or CC-BY-SA-3.0-2.5-2.0-1.0], via Wikimedia Commons. By Hooq38 [CC BY-ND 2.0], via Flickr. Supplied by iStockphoto/Thinkstock.
Basilisk lizards are often found resting on branches of trees that grow next to water. Basilisk lizards can run across the surface of the water.

(a) Draw one line from each adaptation of the lizard to the advantage of the adaptation.

<table>
<thead>
<tr>
<th>Adaptation</th>
<th>Advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toes on the back feet are webbed</td>
<td>Helps the lizard to balance when running</td>
</tr>
<tr>
<td>Long tail</td>
<td>Warning colours to deter predators</td>
</tr>
<tr>
<td>Brown skin</td>
<td>Increases surface area in contact with the water</td>
</tr>
</tbody>
</table>

(b) Suggest one advantage to the basilisk lizard of being able to run across the surface of the water.

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(1)
(c) Animals, such as lizards, compete with each other.

Give two factors that animals compete for.

Tick (✓) two boxes.

Oxygen  

Food  

Territory  

Light  

Q16. On a rocky shore, when the tide goes in and out, organisms are exposed to the air for different amounts of time.

(a) On hot, windy days when the tide is out the concentration of the salt solution in rock pools may become very high.

What term is used to describe organisms that can survive in severe conditions such as very high concentrations of salt solution?

.......................................................................................................................................................... (1)

(b) Periwinkles are types of snail.

Students surveyed the different types of periwinkle living on a rocky shore.

The diagram shows the results of the students’ survey.

The highest position that the sea water reaches on the shore is called the high tide level. Each bar represents the range of habitats for each type of periwinkle.

<table>
<thead>
<tr>
<th>Position on shore</th>
<th>Small periwinkle</th>
<th>Rough periwinkle</th>
<th>Common periwinkle</th>
<th>Flat periwinkle</th>
</tr>
</thead>
<tbody>
<tr>
<td>High tide level</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low tide level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(i) Which two types of periwinkle are likely to compete with each other to the greatest extent?

.......................................................................................................................................................... (1)
(ii) Explain your answer to part (b)(i).

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(1)

(iii) The small periwinkle can survive much nearer to the high tide level than the flat periwinkle.

Suggest two reasons why the flat periwinkle cannot survive near to the high tide level.

1................................................................................................................................................
................................................................................................................................................
................................................................................................................................................
................................................................................................................................................
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2................................................................................................................................................
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(2)

(Total 5 marks)
Q17. Many animals and plants are adapted to stop other organisms eating them.

(a) The photograph shows part of a plant stem.

Suggest how this plant is adapted to stop animals eating it.

Adaptation

........................................................................................................................................................................

Describe how the adaptation helps to stop animals eating the plant.

........................................................................................................................................................................

........................................................................................................................................................................

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(2)
(b) The photograph shows an insect on a plant twig.

By Fir0002 [CC BY-SA 3.0], via Wikimedia Commons

Suggest how this insect is adapted to stop animals eating it.

Adaptation

..........................................................................................................................................................

Describe how the adaptation helps to stop animals eating the insect.

..........................................................................................................................................................

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(c) The photograph shows some insects.

These insects are bright red.

![Insects](https://upload.wikimedia.org/wikipedia/commons/thumb/1/1e/Redinsects2.jpg/600px-Redinsects2.jpg)

By Greg Hume (Greg5030) [CC BY 3.0], via Wikimedia Commons

Suggest how these insects are adapted to stop animals eating them.

Adaptation

........................................................................................................................

Describe how the adaptation helps to stop animals eating the insect.

........................................................................................................................

........................................................................................................................

(2)

(Total 6 marks)


![Jerboa](https://example.com/jerboa.png)

Jerboas sleep in underground holes during the hot day and come out during the cold night.

The jerboa’s main food is small insects which run across the surface of the sand.
For each question write the correct letter in the box.

Which structure, A, B, C, D, E or F:

(a) helps to insulate the jerboa

(b) helps the jerboa to detect insects on a dark night

(c) helps the jerboa to hop quickly to catch an insect

(d) helps the jerboa to keep its balance when hopping

(e) helps the jerboa to know the width of its underground hole in the dark?

(1) (Total 5 marks)

Q19. Deforestation affects the environment in many ways.

(a) Deforestation increases the amount of carbon dioxide in the atmosphere.
Give two reasons why.

1 ..............................................................................................................................................
..............................................................................................................................................

2 ................................................................................................................................................
................................................................................................................................................

(2)

(b) Deforestation also results in a loss of biodiversity.

(i) What is meant by biodiversity?

..............................................................................................................................................
..............................................................................................................................................

(1)
(ii) Give two reasons why it is important to prevent organisms becoming extinct.
1 ..............................................................................................................................
..............................................................................................................................
2 ..............................................................................................................................
.............................................................................................................................. (2)
(Total 5 marks)


Table 1 shows:
• the total area of England, Scotland and Wales
• the area of different types of woodland in these countries.

Table 1

<table>
<thead>
<tr>
<th>Country</th>
<th>Total area of country in thousands of km²</th>
<th>Area of woodland in thousands of km²</th>
<th>Coniferous woodland</th>
<th>Broadleaf woodland</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>England</td>
<td>130</td>
<td>3.6</td>
<td>7.8</td>
<td>11.4</td>
<td></td>
</tr>
<tr>
<td>Scotland</td>
<td>79</td>
<td>10.4</td>
<td>3.0</td>
<td>13.4</td>
<td></td>
</tr>
<tr>
<td>Wales</td>
<td>21</td>
<td>1.9</td>
<td>0.9</td>
<td>2.8</td>
<td></td>
</tr>
</tbody>
</table>

(a) Look at the data for the three countries. Estimate which country has the greatest proportion of its area suitable as a habitat for squirrels.

Support your answer with relevant figures.
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.............................................................................................................................. (2)
(b) The maps show the distribution of grey squirrels and red squirrels in England, Scotland and Wales.

Scientists suggested that the distribution of grey squirrels and red squirrels is linked to the type of trees in woodlands.

(i) The information for England and Scotland supports this suggestion. How?

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(ii) Give one piece of evidence that contradicts this suggestion.

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(1)
Red squirrels are native to the UK. Grey squirrels were introduced to the UK from the USA over 100 years ago.

**Table 2** gives information about the two types of squirrel.

<table>
<thead>
<tr>
<th></th>
<th>Grey squirrel</th>
<th>Red squirrel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population in UK</td>
<td>2.5 million</td>
<td>140 000</td>
</tr>
<tr>
<td>Main food types</td>
<td>Seeds, nuts, tree bark, birds’ eggs, young birds</td>
<td>Cones from coniferous trees, nuts, tree bark, berries</td>
</tr>
<tr>
<td>Health</td>
<td>Can become immune to parapox virus</td>
<td>Cannot become immune to parapox virus</td>
</tr>
<tr>
<td>Reproduction</td>
<td>Up to 9 young, twice a year</td>
<td>Up to 6 young, twice a year</td>
</tr>
<tr>
<td>Survival rate of young in mixed populations</td>
<td>41 %</td>
<td>14 %</td>
</tr>
<tr>
<td>Length of life</td>
<td>2 – 4 years</td>
<td>Up to 7 years</td>
</tr>
</tbody>
</table>

In most parts of the UK the population of grey squirrels is increasing, but the population of red squirrels is decreasing.

Suggest why.

Use information from **Table 2**.

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(3) (Total 7 marks)
M1.  
(a) sulfur dioxide

(b) (i) mutation

(ii) pale form now (more) easily seen (by predators) or dark form now less easily seen (by predators)  
accept ref to camouflage

so pale form (more) likely to be eaten or dark form less likely to be eaten

so dark form (more likely to) breed / pass on genes

or

pale form less likely to breed / pass on genes

(c) (i) pyramid of three layers of diminishing size  
either way up

three labels in food chain order  
award 2 marks only if the pyramid is correctly labelled  
accept trees / birch  
accept (peppered) moth(s) / larvae

(ii) some material is lost in waste from the birds

peppered moth larvae do not eat all the leaves from the trees

M2.  
(a) it has a long/thin beak;  
which enables it to reach down the long flower tube/OWTTE;  
(allow qualified answers in terms of wings)  
(allow two adaptations)
(b) it has a sharp beak;
which enables it to peck through the base of the flower tube/OWTTE
*(allow qualified answers in terms of feet)*
*(allow two adaptations)*
each for 1 mark

M3. 
7 of e.g.
need for resumption of *some* legal trading because:
conservation costs money
need to generate income
to justify giving over tracts of land needed to support it
need to keep elephant numbers consistent with vegetation available
need for hard currency by African countries
counter arguments:
‘right to life’ of elephants
need to prevent effects of poaching on numbers
if trading allowed again
each for 1 mark

M4. (a) points plotted accurately

\[ \frac{1}{2} \text{ square} \]

deduct 1 mark per error
ignore the line

(b) 30 or correct from candidate’s graph

accept 30 000 lynx
do not accept 30 000

(c) (i) fall

mark (i) and (ii) separately

(ii) fewer hares or lack of food

do not accept no hares or food
(d) kills / preys / preys on / hunts / catches and eats / for food (other) animals

1 must have the eat and kill for the point

M5. (the layer of fat under the skin) insulates the penguin

1 (the streamlined body) reduces resistance from water, enabling the penguin to swim faster to catch fish

1 (the oily feathers) prevent cold water reaching skin

1

M6. (a) (i) correct reasons - different

light

protection

moisture

pH/acidity/alkalinity

temperature

soil

nutrients

air

1 genetic differences

any 2 for 1 mark each

[mind solely on different environmental condition]

2 (ii) Grow different dandelions in the same conditions

1 mark each

or

Grow the same type of dandelions in different conditions

1 mark each

2 (b) Dandelions shorter/smaller/same height

1 mark

because (named) condition changes

1 mark

[may refer to answer in a(ii)]

2
M7. (a) any two from: eg

• same volume of solution
do not allow same size of container

• left for same length of time

• same temperature

• same oxygen

• same pH

• same number of invertebrates / animals
do not allow same number of species

• same age / stage of invertebrates / animals

(b) line of best fit / curve / point to point drawn going through 240-260 and 25

   correct interpolation to X axis
   if no work on graph allow 250

(c) (i) (C)

   50% killed at lowest / low copper concentration
   ignore least survivors

(ii) any two from:

• involves counting
easy to count gains 2 marks

• easy to do

• invertebrates more sensitive

• needs less / no apparatus
ignore more reliable / accurate

[7]

M8. (a) wing pattern similar to Amauris

   birds assume it will have foul taste
(b) mutation / variation produced wing pattern similar to *Amauris*  
*do not accept breeds with Amauris*  
*do not accept idea of intentional adaptation*  
1  
these butterflies survived  
1  
breed / genes passed to next generation  
1  

M9.  
(a) 4 of:  
intensification due to need to improve efficiency of energy transfer;  
has led to developing fast growing crop varieties;  
native plants cannot compete with these;  
for e.g. light/water/minerals;  
effect of herbicides;  
pesticides killing pollinating insects  
*each for 1 mark*  
4  
(b) recommend a variety of measures; (can be implied)  
because rotational will allow these species to continue;  
permanent will allow others;  
leading to conservation of a wide range of species  
*each for 1 mark*  
4  

M10.  
(a) predator  
prey  
*no alternatives*  
*for 1 mark each*  
2  
(b) *idea that* (wasps) increase OR decrease  
gains 1 mark  
*but* (wasps) increase then decrease/peaks at  
gains 2 marks  
*answers must match*
idea of change in food supply/whiteflies
more food/whiteflies OR less food/whiteflies
  gains 1 mark

but
more food/whiteflies then less food/whiteflies
  gains 2 marks

or
wasps follow trend in whiteflies
  for 2 marks

or
linked to increase/decrease other environmental effects
e.g. more/less food for wasps, use of insecticide
e.g. temperature change, other predator
If increase/decrease not given then second part (reason) gains no marks
  for 1 mark each

(c)  idea that
wasps die out/die off/fly away/migrate/leave greenhouse but NOT ‘die’ alone
  for 1 mark

M11.  (a)  any two from:
•  long / pointed horns and for defence
•  large ears and to hear predators approaching
•  appearance blends with background and gives camouflage
  allow long legs and to run away or to kick predators
  allow tall and can see predators a long distance away
  allow eyes on the sides of their heads and to have all-round vision
  to spot predators

(b)  (i)  evaporation / transpiration

(ii)  19.30 and 08.00

(iii)  this is when the moisture content in grass is highest
  therefore animal takes in most water if it eats at this time

(c)  (i)  to reduce water loss (in dry area) / conserve water

(ii) large surface area of blood vessels / dilation of blood vessels
   for evaporation / radiation

(iii) intertwining results in close contact of arteries and veins or
     splitting up of arteries and veins ensures larger surface area in contact
     cool venous blood cools arterial blood

M12. (a) (i) quadrat / grid
   allow suitable description in a(i) or a(ii)
   allow quadrant

(ii) any two from:
   • use a transect / description
     allow measure distance of the test or sample site from road
   • sample every metre
     ignore random placing of quadrat
   • count plants (in quadrat)

(iii) the nearer to the road, the more (plantain) plants
     accept the more dead nettles the less plantains
(b) (i) any two factors from: eg

- grow better / survive away from road
- sensitive to pollutant / named pollutant / dust / fumes
  *ignore carbon dioxide as pollutant*
- (roadside) weedkillers
- trampling / damage / turbulence
- grass cutting
- competition
- aspect eg hillier

or

give one mark for a factor and one mark for its effect eg
dust (from road) (1)
reduces photosynthesis (1)

or

‘loses’ in competition (1)

for light / water / nutrients / minerals / ions / space / soil (1)
  *ignore food for plants*
(ii) any two factors eg

ignore distribution

• can withstand pollution
  allow grows better in polluted air
  ignore ‘prefer’ pollution

• competition

• aspect eg flat

or

give one mark for a factor and

one mark for its effect eg

use carbon dioxide (from traffic) (1)

enhances photosynthesis (1)

or

‘wins’ in competition (1)

ignore food for plants

for light / water / nutrients / minerals / ions / space (1)

M13. (a) any two from:

• shorter distance between samples
  ignore repeat investigation /measurements

• sample to greater height

• specify the size of each site
  ignore longer transect

(b) (i) Parmelia

(ii) Evernia
(c) any two from:

- Lecanora does not extend over whole range of transect / does not grow everywhere / does not grow in town centre / does not grow in countryside

- Lecanora grows in a range of sulfur dioxide concentrations or Lecanora only grows in limited range of sulfur dioxide concentrations or Lecanora lives over large range of sulfur dioxide concentrations

- other factors eg different pollutant might also influence growth of Lecanora

- sulfur dioxide / pollutant concentration was not measured
  
  *ignore Lecanora does not give accurate measure of sulfur dioxide concentration*

- amount of Lecanora not measured
M14.

all four correct = 4 marks
three correct = 3 marks
two correct = 2 marks
one correct = 1 mark
extra line from a statement cancels the mark
M15. (a) 

one mark for each line 
**do not** award mark for an adaptation if lines are drawn from it to more than one advantage 

(b) escape (predators) 

- accept faster than swimming 
- allow chase prey 
- allow it stops them from drowning 

(c) food 

- territory 

**deduct one mark for each tick in excess of two** 

M16. (a) extremophile(s) 

(b) (i) common (periwinkle) and flat (periwinkle) 

- **either order, both required** 

(ii) (common and flat) both live in the same habitat / area / named area 

- **allow habitats overlap the most**
(iii) any two from:

- would have wrong food
- would otherwise be exposed to (specific) predators
- cannot tolerate extended exposure to air or reduced submersion in seawater
  allow cannot tolerate temperature / dehydration
- cannot tolerate high salt concentration (in rock pools)
  allow low salt concentration (in rock pools)
- cannot compete with small periwinkle

M17. (a) answer to be marked as a whole

has thorns / prickles / points
accept sharp points

(these) hurt animal
allow frighten animal
only accept prevent animal eating leaves if qualified by 'hurting' or 'frightening'

(b) answer to be marked as a whole

camouflaged / looks like twig / disguised
allow blends in
ignore too small to see

(animal) cannot see / detect / recognise it
allow animal does not eat twigs
only accept prevents animal eating it if qualified by 'seeing' or 'wrong food'

(c) answer to be marked as a whole

red / colour

warns that insect might be poisonous / dangerous
allow inedible / tastes bad
M18. (a) C
(b) B
(c) E
(d) D
(e) F

M19. (a) any two from:

* burning
* activity of microbes / microbial respiration
* less photosynthesis

or

trees take in CO₂

* do not accept CO₂ taken in for respiration

or

less CO₂ locked up in wood

* CO₂ given off by clearing machinery

(b) (i) range of different species

* accept idea of variety of organisms or plants or animals
(ii) any two from:

- organisms may produce substances useful to humans
do not accept if food is only example
- duty to preserve for future generations
- effect on other organisms, eg food chain effects
ignore effect on human food supply
- loss of environmental indicators

M20. (a) Scotland

any one from

- Scotland 15 to 20% / about 1/5th to 1/7th but England and Wales / the others are less / lower / reasonable estimated figures

- \[ \frac{13.4}{79} \] is greater than England / \[ \frac{11.4}{130} \] and Wales / \[ \frac{2.8}{21} \]

(b) (i) broadleaf woodlands have more grey squirrels or broadleaf woodlands have less red squirrels
allow converse referring to conifers

(ii) Wales has more conifers and / but more grey squirrels or Wales has less broadleaf and / but more grey squirrels
allow converse for red squirrels

(c) any three from:

answers must be comparative they = grey squirrels
grey squirrels
allow converse arguments for red squirrels

- have wider range/ more types of food
- are resistant to parapox (virus) but reds are not ignore reference to other disease
- have more young each year/litter
- young more likely to survive (in mixed populations)