4.7 Ecology
Higher

Name: _____

Class: _____

Date: _____

Time: **236 minutes**

Marks: **236 marks**

Comments:

Q1.

The UK contains large areas of peat bogs that have been present for thousands of years.

(a) Peat is removed from peat bogs.

The peat can be mixed with air and added to garden compost.

The release of carbon dioxide from peat is a problem.

Give **two other** reasons why gardeners should use less peat-based compost in the future.

1. _____

_____

2. _____

_____

(2)

(b) Explain why mixing peat with air leads to the release of carbon dioxide.

_____

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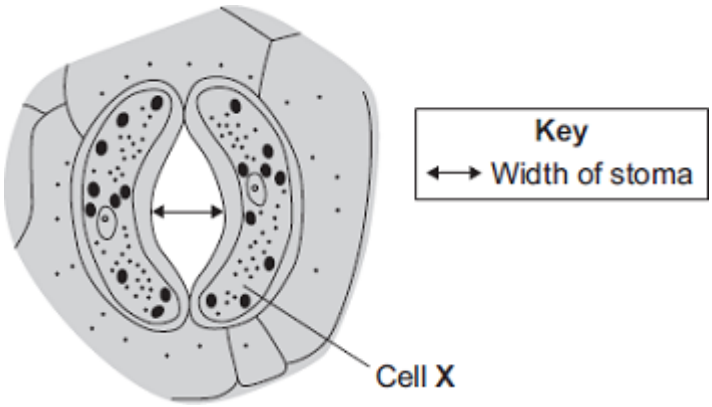
(4)

(Total 6 marks)

Q2.

Plant leaves have many stomata.
The diagram shows a stoma.



(a) Name cell **X** _____

(1)

(b) The table shows the mean widths of the stomata at different times of the day for two different species of plant.
Species **A** grows in hot, dry deserts.
Species **B** grows in the UK.

	Time of day in hours	**Mean width of stomata as a percentage of their maximum width**	
		Species A	**Species B**
Dark	0	95	5
	2	86	5
	4	52	6
Light	6	6	40
	8	4	92
	10	2	98
	12	1	100
	14	0	100
	16	1	96
	18	5	54
Dark	20	86	6
	22	93	5
	24	95	5

The data in the table show that species **A** is better adapted than species **B** to living in hot, dry deserts.

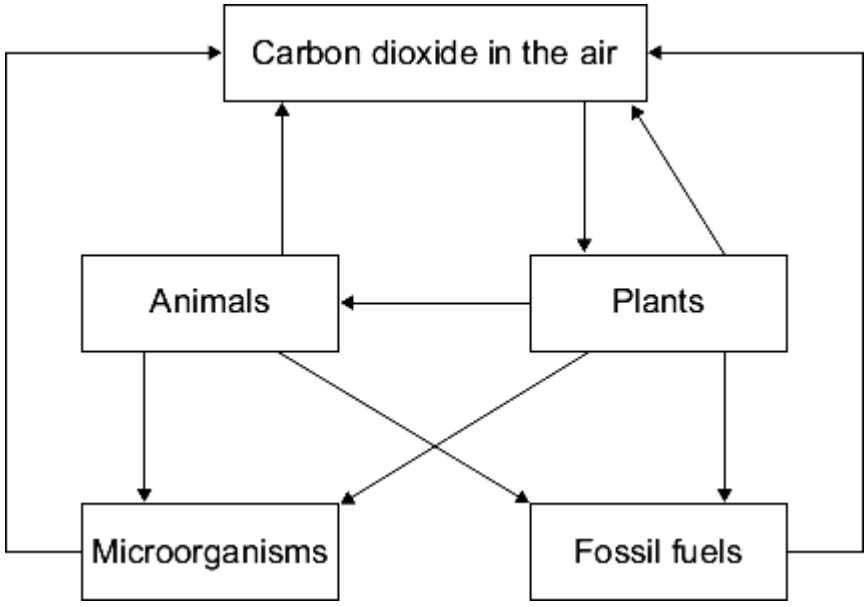
Explain how.

(4)

(Total 5 marks)

Q3.

The diagram shows part of the carbon cycle.



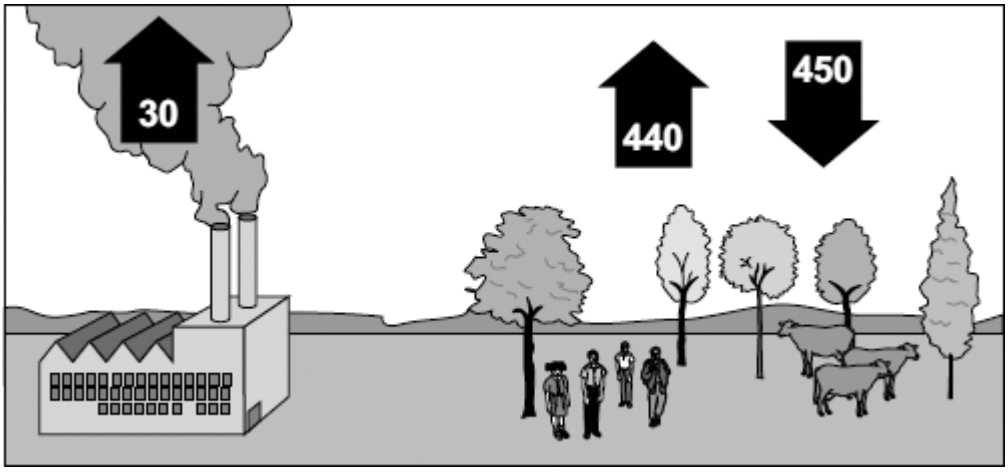
Use the information in the diagram and your own knowledge to describe in detail how carbon is cycled between living organisms and the air.

Your answer should include the names of any processes involved.

(Total 6 marks)

Q4.

The diagram shows the mass of carbon dioxide released into and removed from the air each year in billions of tonnes.



Describe the processes **shown on the diagram** that exchange carbon dioxide with the air.

Explain the overall effect of these processes on the mass of the carbon dioxide in the air.

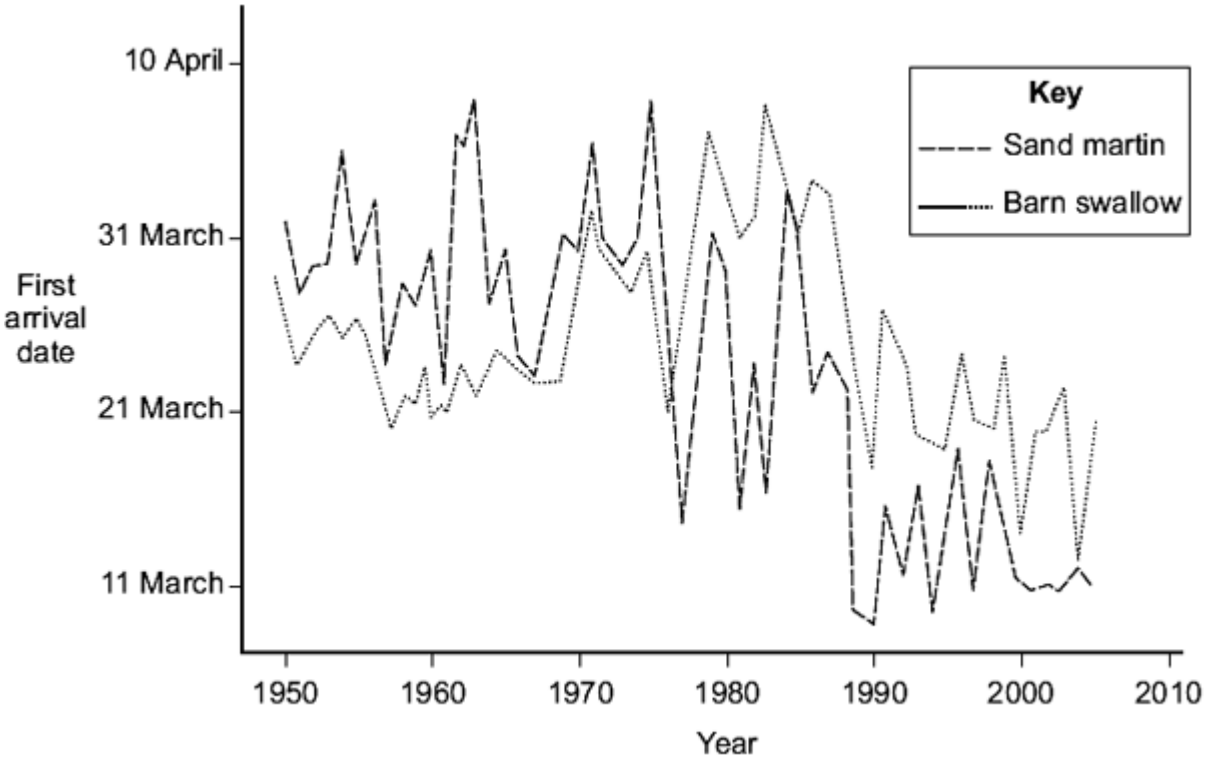
(Total 6 marks)

Q5.

Scientists have observed changes in the migration patterns of some species of birds.

The graph shows the arrival dates in the UK of two species of birds, the Sand martin and the Barn swallow.

Both birds feed on flying insects.



(a) Give **two** changes in migratory patterns shown in the data.

_____

_____

_____

_____

(2)

(b) Suggest reasons for the change in the migration pattern of the Sand martin.

_____

_____

_____

_____

(2)

(Total 4 marks)

Q6.

Approximately a third of UK domestic rubbish is organic matter such as food waste and

gardening rubbish.

Many councils have started industrial composting schemes to decompose these wastes. One product of the decomposition is compost (decaying organic matter).

Use this information and your own knowledge to suggest reasons why more councils should be encouraged to start industrial composting schemes.

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(Total 3 marks)

Q7.

The figures below show the levels of carbon dioxide in air from 150 000 years ago.

TIME	CARBON DIOXIDE CONCENTRATION
1500 years ago	270 parts per million
1800 AD	290 parts per million
1957	315 parts per million
1983	340 parts per million

(a) Explain why carbon dioxide levels in the atmosphere are changing.

_____

_____

_____

_____

_____

(3)

(b) It is suggested that the increased level of carbon dioxide in the air is causing the atmosphere to warm up (the “Greenhouse Effect”).

Describe, as fully as you can, **two** major effects of global warming and how these may affect the human population.

_____

_____

_____

(6)

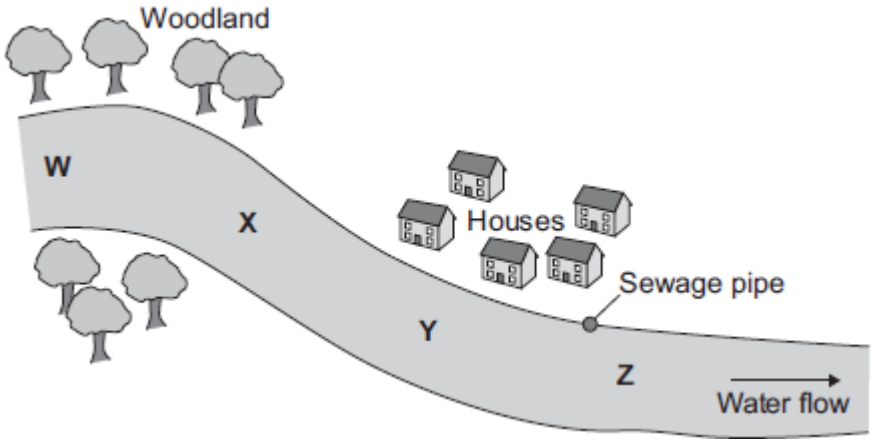
(Total 9 marks)

Q8.

Two groups of students, **Group 1** and **Group 2**, were monitoring the oxygen concentration in a river.

They measured the oxygen concentration of the water at points **W**, **X**, **Y** and **Z**. The measurements were taken on the same day, but the two groups used different oxygen sensors.

The sensors for both groups were working properly.



The results for the two groups are shown in the table.

	Concentration of oxygen in arbitrary units			
Sampling position	**W**	**X**	**Y**	**Z**
Group 1	9.4	9.3	9.4	8.5
Group 2	9	9	9	9

(a) The results of **Group 2** did not show any difference in the concentration of oxygen at the four different sampling positions. The results of **Group 1** did show differences.

Suggest why.

_____

_____

(1)

(b) The results of **Group 1** show the lowest concentration of oxygen was at sampling position **Z**.

Suggest why.

_____

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_____

_____

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(3)

(c) The students also counted the number of different invertebrates living in the river at points **W**, **X**, **Y** and **Z**.

The results are shown in the table.

Invertebrate	**Sampling position**			
	W	**X**	**Y**	**Z**
Stonefly larva	4	5	4	0
Water snail	16	15	16	10
Bloodworm	0	0	0	25
Freshwater louse	6	5	7	5

From these results, which invertebrate is **not** suitable as an indicator of oxygen concentration in water?

_____

Give a reason for your choice.

_____

_____

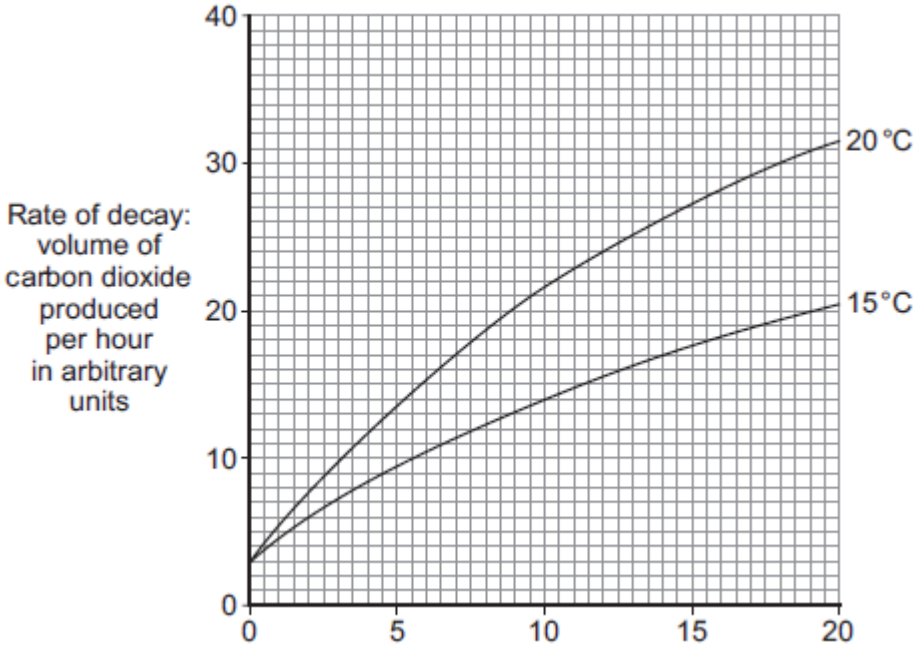
(1)

(Total 5 marks)

Q9.

A scientist investigated the effect of oxygen concentration and temperature on the rate of decay of leaves in a container.

The scientist's results are shown in the graph.



(a) The rate of decay is measured as the volume of carbon dioxide produced per hour.

Explain why carbon dioxide is produced during the process of decay.

(3)

(b) Give **two** conclusions that can be made from the results shown in the graph.

(2)

(Total 5 marks)

Q10.

In a stable community, the processes that remove carbon are balanced by processes that return carbon.

The figure below shows a woodland community.

Describe how carbon is recycled in a woodland community.

(Total 6 marks)

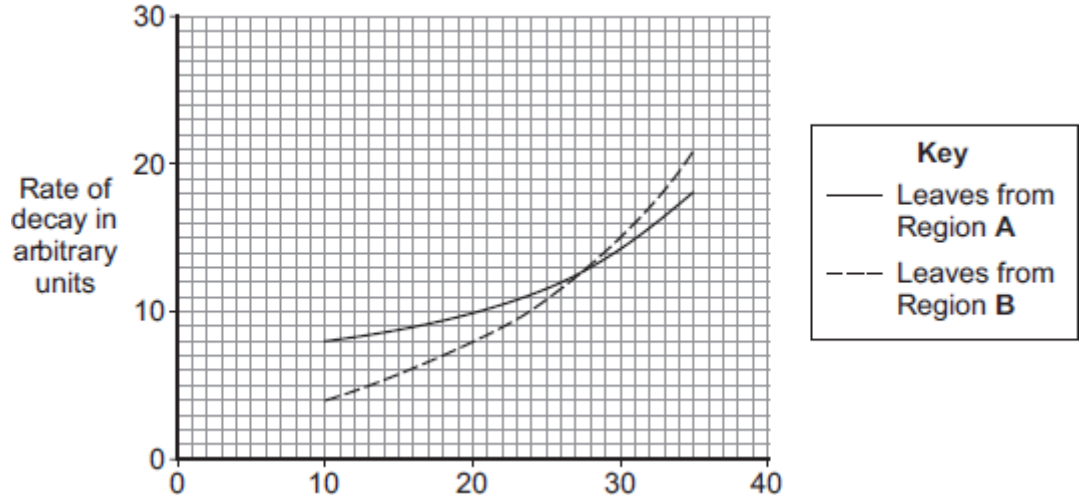
Q11.

Scientists collected leaves that had fallen from beech trees in two different parts of the UK, Region **A** and Region **B**.

Equal masses of leaves from the two regions were put in incubators at different temperatures. All other conditions were the same.

The leaves decayed in the incubators. The rate of decay of the leaves was measured.

The results are shown in the graph.



Give **two** conclusions you can make from the data and suggest a reason for each conclusion.

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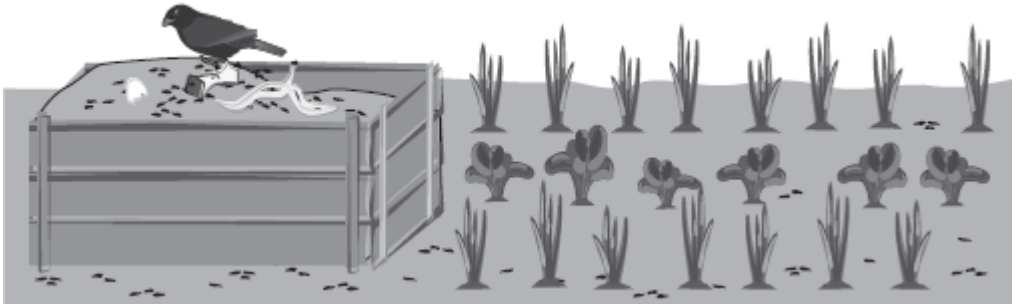
(Total 4 marks)

Q12.

A chef built a compost heap to recycle his vegetable and fruit peelings.

The compost heap soon had many earthworms living in it. The earthworms burrowed through the compost heap and ate the vegetable and fruit peelings. Blackbirds visited the compost heap and ate some of the earthworms.

The image shows the compost heap in the chef's vegetable garden.



(a) Suggest **two** reasons why having a compost heap is useful to the chef.

_____

_____

_____

_____

(2)

(b) The chef covered the compost heap with a plastic sheet. The plastic sheet stopped the birds eating the earthworms and also helped the decay process.

Suggest how the earthworms **and** the plastic sheet helped to speed up the process of decay.

_____

_____

_____

_____

_____

_____

(3)

(Total 5 marks)

Q13.

Earthworms are important soil organisms. When they burrow, they help to bring air into the soil as well as improving drainage. Earthworms also bury leaves in the soil. These decay making the soil more fertile. Earthworms in turn are eaten by voles, moles, foxes, badgers and birds.

New Zealand flatworm

In some parts of the United Kingdom, earthworms are being killed by New Zealand flatworms. The animals are spreading quickly and have no natural enemies.

The flatworms do not make their own burrows. They only use the burrows made by the earthworms in order to attack them.

(a) Explain, as fully as you can, why it is important to control or get rid of these New

Zealand flatworms in Britain.

(4)

(b) Suggest **one** possible way, giving **one** advantage and **one** disadvantage, that this New Zealand flatworm could be controlled.

(3)

(Total 7 marks)

Q14.

The photograph shows a sand gazelle.

The sand gazelle lives in the Arabian Desert where temperatures often reach 45 °C.

(a) The sand gazelle feeds only at dawn and at dusk. At other times it stays in the shade.

Suggest how this helps the animal to conserve water.

_____

_____

_____

_____

(2)

(b) During the dry season, the sand gazelle's liver and heart shrink in size. This reduces the amount of oxygen that the body needs.

Suggest how needing less oxygen helps the animal to conserve water.

_____

_____

_____

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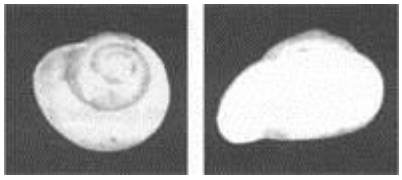
(2)

(Total 4 marks)

Q15.

Cepaea nemoralis is a snail which is found on sand dunes. It may have a plain or banded shell. The snails are found on grass stalks and leaves.



Plain

Banded

When a scientist collected snails on the sand dunes he got 450 banded
280 unbanded.

Snails are eaten by birds. Sand dunes have clumps of grasses growing on them.

Suggest why there were more banded than unbanded snails on the sand dunes.

_____

_____

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_____

_____

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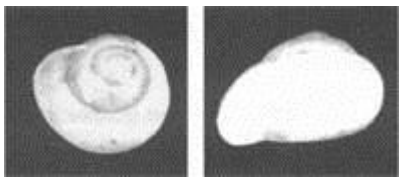
(Total 4 marks)

Q16.

Cepaea nemoralis is a snail which is found on sand dunes. It may have a plain or banded shell. The snails are found on grass stalks and leaves.



Plain

Banded

A scientist collected young unbanded snails and kept them until they were fully grown and mated them.

The eggs laid produced 35 unbanded and 12 banded snails.

(a) Explain these figures as fully as you can. You may use a genetic diagram if you wish to make your answer clearer.

_____

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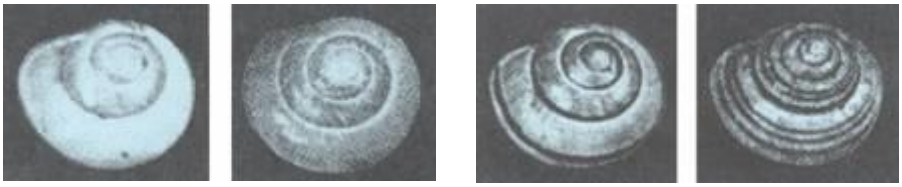
(7)



Variation in colour

Variation in banding

(b) The snail shells show a lot of variation in colour. They are yellowy/green, brown, pink or cream. The banding varies from a single wide band to a mixture of thick and thin bands.

Describe briefly the factors which have produced this variation and explain how these factors may themselves have arisen.

(4)

(Total 11 marks)

Q17.

Read the passage.

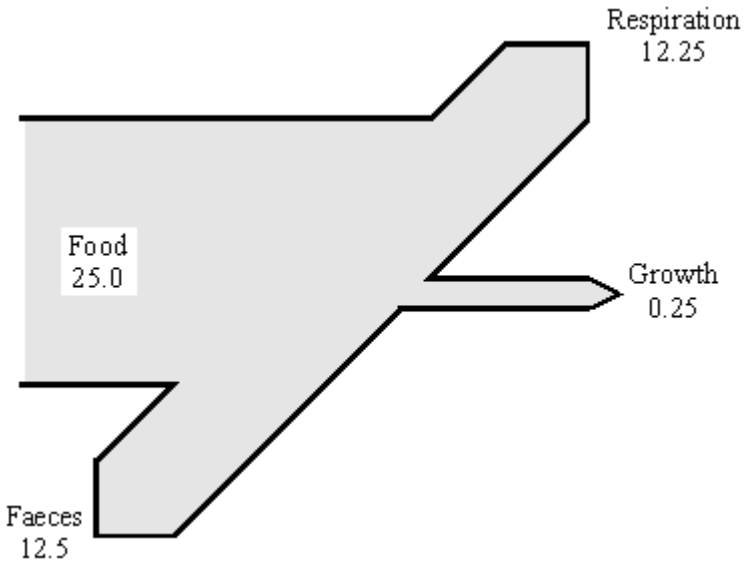
Glutton up a gum tree

Along the banks of the Cygnet River on Kangaroo Island, the branches of the dying gum trees stretch out like accusing fingers. They have no leaves. Birds search in vain for nectar-bearing flowers.

The scene, repeated mile upon mile, is an ecological nightmare. But, for once, the culprit is not human. Instead, it is one of the most appealing mammals on the planet – the koala. If the trees are to survive and provide a food source for the wildlife such as koalas that depend on them, more than 2000 koalas must die. If they are not removed the island's entire koala population will vanish.

Illegal killing has already started. Worried about soil erosion on the island, some farmers have gone for their guns. Why not catch 2000 koalas and take them to the mainland? "Almost impossible," says farmer Andrew Kelly. "Four rangers tried to catch some and in two days they got just six, and these fought, bit and scratched like fury."

The diagram shows the flow of energy through a koala.
The numbers show units of energy.



(i) Calculate the percentage of the food intake which is converted into new tissues for growth. Show your working.

_____ %

(2)

(ii) Give **three** different ways in which the koala uses the energy released in respiration.

1. _____

_____

2. _____

_____

3. _____

_____

(3)

(Total 5 marks)

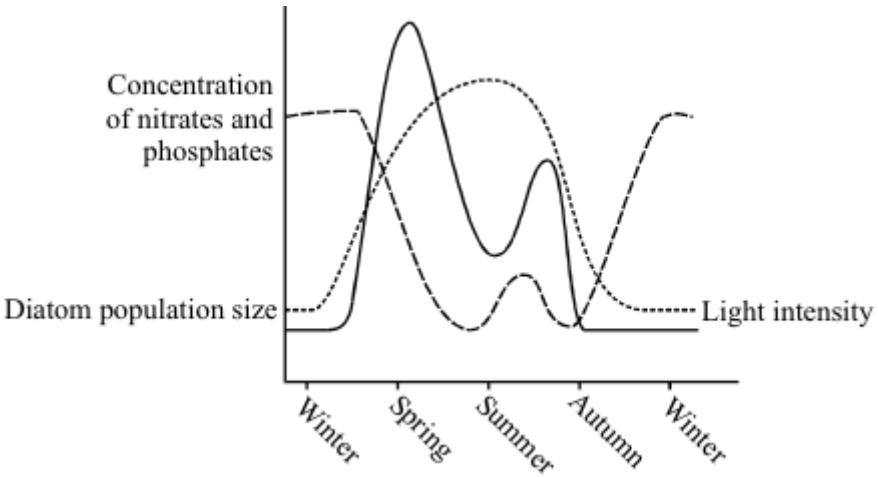
Q18.

A food chain in the North Atlantic Ocean is:

diatoms → small fish → large fish

The graphs show how over a year:

- the population size of diatoms in the North Atlantic varies;
- the light intensity alters;
- the concentration of nitrate and phosphate minerals alters.



(a) Explain why the light intensity is a major factor in controlling the numbers of diatoms.

_____

_____

_____

(2)

(b) (i) Suggest **two** reasons why the population of diatoms decreases between spring and summer.

1. _____

_____

2. _____

_____

(2)

(ii) Give **two** reasons why the population of diatoms decreases in autumn.

1. _____

_____

2. _____

_____

(2)

(c) Use the information on the graph to suggest what change causes the number of diatoms to increase in the late summer. Give a reason for the change.

_____

_____

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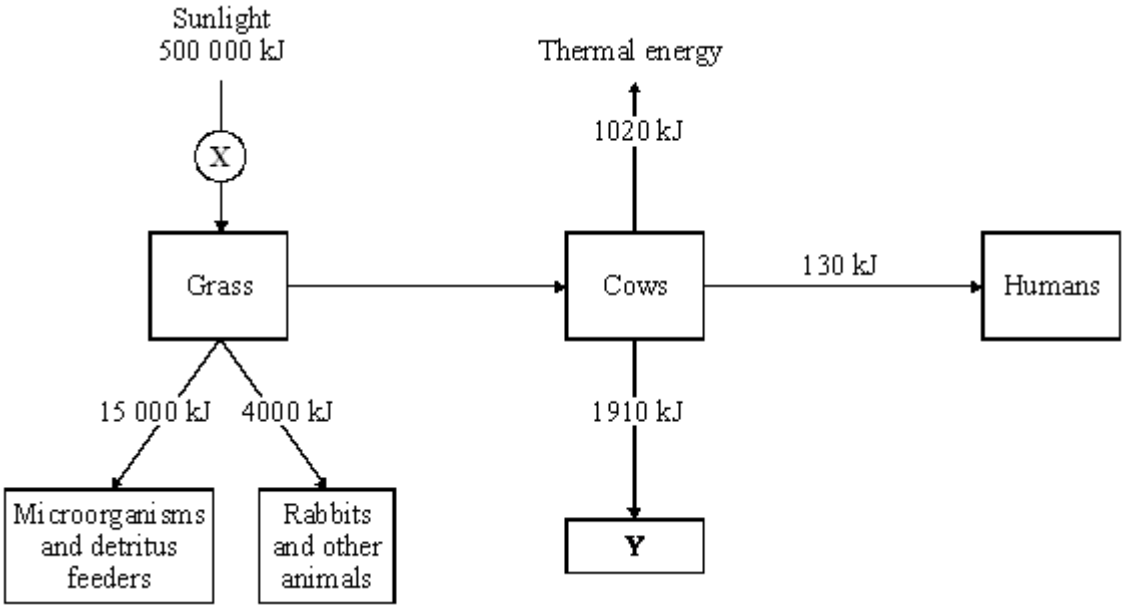
(2)

(Total 8 marks)

Q19.

The diagram shows the amounts of energy that are transferred, over a period of time, through some living things in a grassland habitat.



(a) Calculate the amount of energy transferred from the grass to the cows.

_____

_____

Amount of energy = _____ kJ

(1)

(b) **X** is a process in plants.

(i) Calculate the amount of energy usefully transferred by process **X**.

_____

_____

_____

Amount of energy = _____ kJ

(1)

(ii) Name process **X**.

_____

(1)

(c) Give **two** ways in which energy is 'lost' from the cows at **Y**.

1. _____

_____

2. _____

_____

(2)

(d) Describe how hormones can be used to improve the efficiency of producing food from plants.

_____

_____

_____

_____

(2)

(Total 7 marks)

Q20.

Read the passage.

Glutton up a gum tree

Along the banks of the Cygnet River on Kangaroo Island, the branches of the dying gum trees stretch out like accusing fingers. They have no leaves. Birds search in vain for nectar-bearing flowers.

The scene, repeated mile upon mile, is an ecological nightmare. But, for once, the culprit is not human. Instead, it is one of the most appealing mammals on the planet – the koala. If the trees are to survive and provide a food source for the wildlife such as koalas that depend on them, more than 2000 koalas must die. If they are not removed the island's entire koala population will vanish.

Illegal killing has already started. Worried about soil erosion on the island, some farmers have gone for their guns. Why not catch 2000 koalas and take them to the mainland? "Almost impossible," says farmer Andrew Kelly. "Four rangers tried to catch some and in two

days they got just six, and these fought, bit and scratched like fury."

Use the information from the passage and your own knowledge and understanding to give the arguments for and against killing koalas to reduce the koala population on Kangaroo Island.

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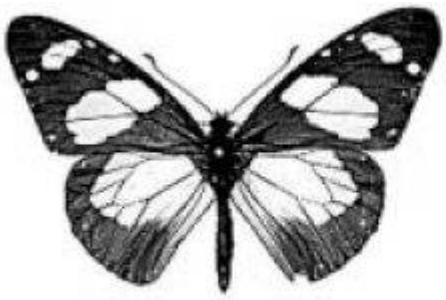
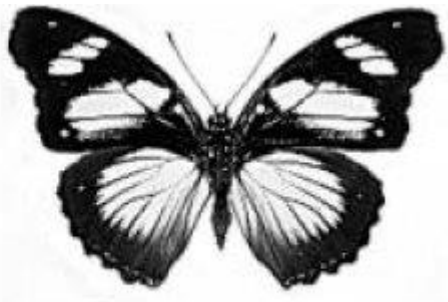
(Total 4 marks)

Q21.

The drawings show two different species of butterfly.



Amauris



Hypolimnas

- 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*.

_____

_____

_____

_____

(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)

Q22.

Professor John Lawton researches into the problem of controlling the spread of bracken. Bracken is a fern which threatens upland farms, partly because it poses a health risk to people and animals.

Professor Lawton is waiting for government permission to release the Conservular caterpillar which feeds on the bracken.

The Secretary of State has to decide whether the Conservular caterpillar can be released.

The article printed below describes some of the problems faced by the Secretary of State.

David the caterpillar to bracken's Goliath

Yorkshire farmer Maurice Cottrill has just forked out £500 to have a helicopter hover over his land and spew out gallons of chemicals aimed at destroying one of the most pervasive and dangerous weeds known to man – bracken. In a little box in a laboratory near Ascot, Berkshire, lies a tiny caterpillar which could have done the job for nothing.

Whether or not that caterpillar and thousand of its chums will ever be let loose on the massive carpet of bracken that is sweeping over Britain at the rate of 53 square kilometres a year has to be decided by the Secretary of State for the Environment.

Weed control through the release of imported insects has never been tried in Britain before. If the Secretary of State permits the experiment, the caterpillar is in for the feast of its life, because five years of painstaking research have proved that bracken is its only food. However, is that the full story? Will the beast stop there, or will it go on, wreaking unforeseen devastation. Can scientists predict what will happen when imported insects are released into the wild?

Bracken is poisonous – more than 20 000 sheep and 1 000 cattle suffer poisoning each year. Its spores are carcinogenic, posing a threat to hill walkers. Bracken costs a depressing £4m a year to control while rendering useless grazing land valued at £5m annually. "Bracken is one factor which is leading to hill farming becoming uneconomic", says the director of the Ramblers Association. "We are worried about that because, the more uneconomic hill farms become, the more prospect there is of the forestry

industry taking over."

The National Farmers Union are concerned about the consequences of the caterpillar getting out of control. What if it started consuming garden ferns? What if it loved potatoes? On the other hand, the caterpillar might help to preserve important uplands where wildlife flourishes when bracken is kept at bay. However, the experiment takes the scientists into unknown territory.

World-wide, 94 species of weeds have been controlled by biological releases involving 215 types of animal in 50 countries. Professor Lawson says that approximately one-third have achieved effective control and the remainder have failed.

Upland farms are artificial ecosystems, created and maintained mainly for the rearing of sheep and cattle. These farms are being threatened by the spread of bracken. Up to now the only treatment for bracken has been to use herbicides.

Use the article to explain, as fully as you can, what advice you would give the Secretary of State.

Explain the arguments for and against that lead to your decision.

You will **not** receive marks for simply copying extracts from the article.

(Total 8 marks)

Q23.

Large areas of rain forest are being cleared and burnt in many parts of the world. The cleared land will often produce crops for only a few years.

(a) Explain why rain forests are being burnt to provide land for crops in many parts of the world.

_____

_____

_____

_____

(2)

(b) Explain why such cleared land will often produce crops for only a few years.

_____

_____

_____

_____

(2)

(c) Explain the effects that large-scale burning of forests may have on the Earth's atmosphere in the short and in the long term.

_____

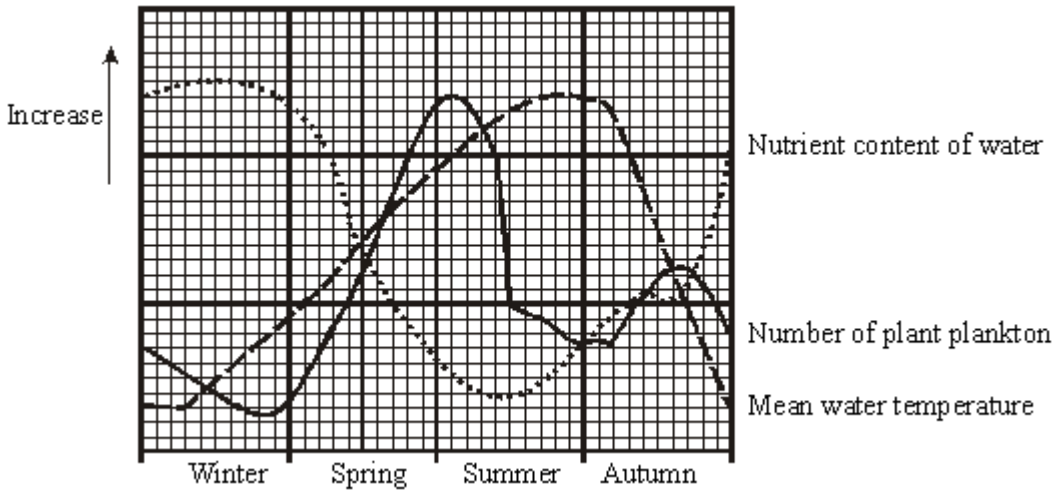
_____

(4)

(Total 8 marks)

Q24.

Plant plankton are aquatic microscopic organisms that photosynthesise. The graph shows the numbers of plant plankton in the North Sea at different times of the year.



Use the data and your knowledge of photosynthesis and growth to explain:

(a) why numbers of plant plankton were low in winter but increased rapidly during the spring,

(3)

(b) the reduction in numbers of plant plankton in the early summer.

_____

_____

_____

(1)

(Total 4 marks)

Q25.

In tropical areas of the world, forests are being cut down at the rate of 150 hectares every minute of every day.

(a) Give **two** reasons why forests in tropical areas are being cut down at a high rate.

1. _____

_____

2. _____

_____

(2)

(b) Explain how this deforestation is affecting the composition of the atmosphere.

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_____

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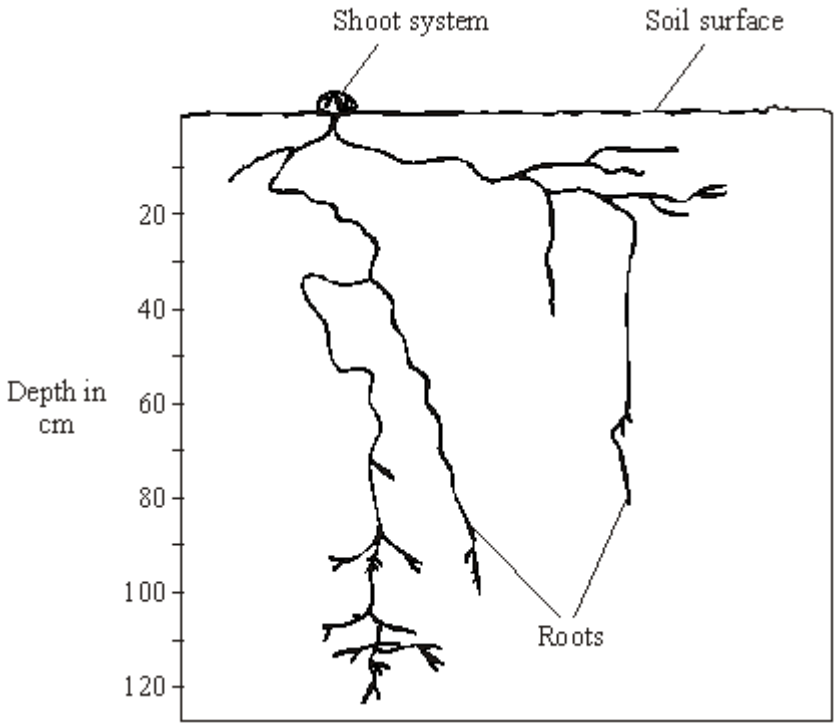
(5)

(Total 7 marks)

Q26.

The diagram shows the desert plant, *Fredolia.*



Describe and explain **three** adaptations of *Fredolia,* which you can see in the diagram, that help it to survive in dry conditions.

1. _____

_____

2. _____

_____

3. _____

_____

(Total 3 marks)

Q27.

Squirrels live in woodland.

Table 1 shows:

- the total area of England, Scotland and Wales
- the area of different types of woodland in these countries.

Table 1

Country	Total area of country in thousands of km^2	Area of woodland in thousands of km^2		
		Coniferous woodland	Broadleaf woodland	Total
England	130	3.6	7.8	11.4
Scotland	79	10.4	3.0	13.4

Wales	21	1.9	0.9	2.8

(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.

_____

_____

_____

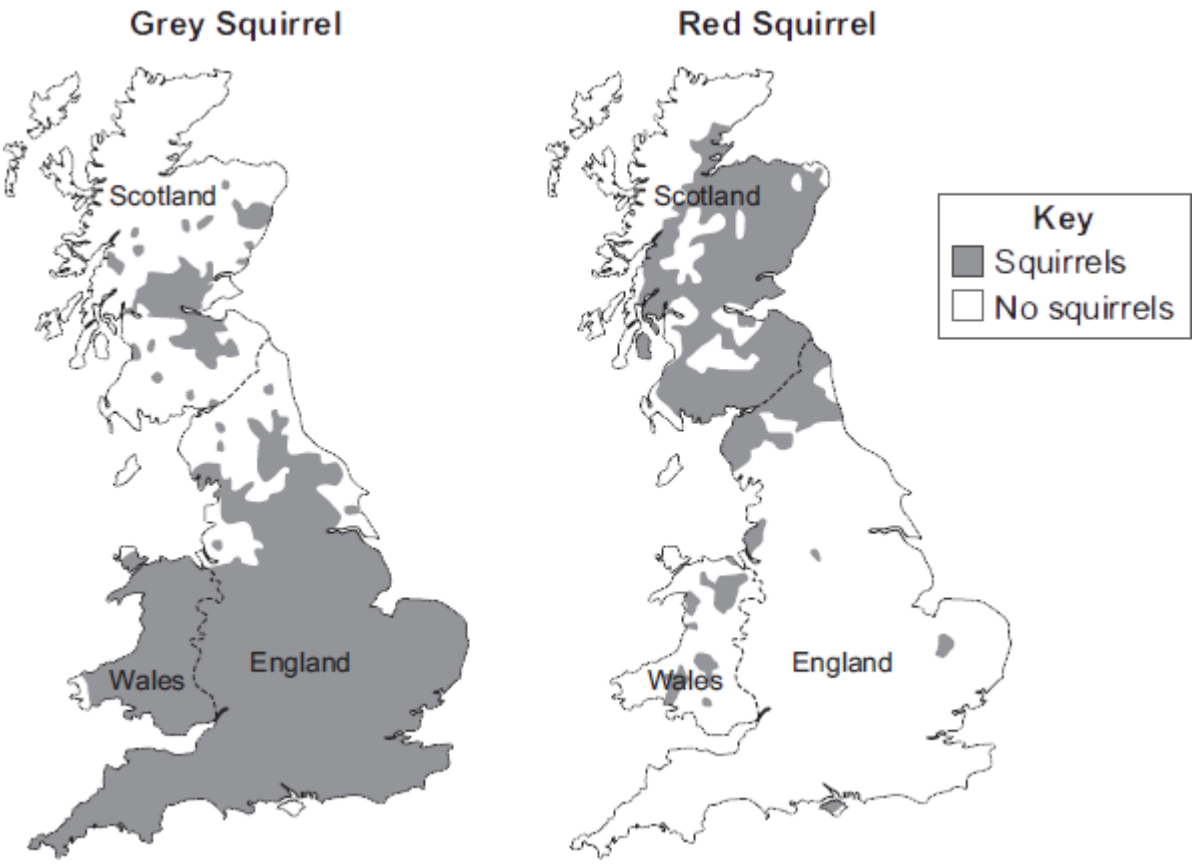
_____

_____

_____

(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?

_____

_____

(1)

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

_____

_____

(1)

(c) 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 2

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

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**.

_____

_____

_____

_____

_____

_____

_____

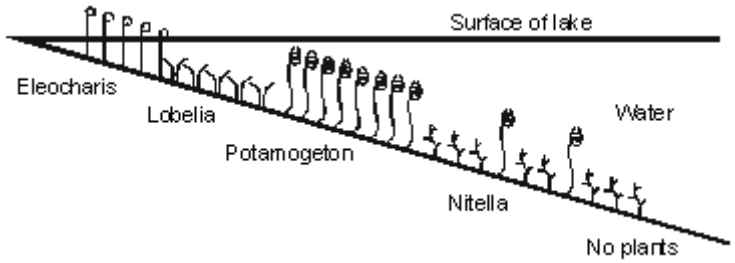
_____

(3)

(Total 7 marks)

Q28.

This is a diagram of a belt transect showing the major types of plants growing on the bottom of a lake.



(a) Suggest, and explain, **two** reasons why a much smaller population of Nitella plants is found amongst the Potamogeton plants than further down in the lake.

1. _____

_____

_____

_____

2. _____

_____

_____

_____

(4)

(b) Describe how you would use the belt transect technique to measure the abundance and distribution of plants which live on the bottom of a shallow lake.

_____

_____

_____

_____

_____

_____

(3)

(Total 7 marks)

Q29.

In the last 200 years the concentration of carbon dioxide in the Earth's atmosphere has risen.

Explain how a rise in carbon dioxide concentration in the atmosphere can decrease biodiversity.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(Total 6 marks)

Q30.

Scientists have discovered that curry spices affect sheep and cattle. Curry spices can reduce the amount of methane that grazing animals give off.

'Bad' bacteria in the animal's stomach produce methane. About 12% of the animal's food is changed into methane.

The curry spice coriander works like an antibiotic. Adding coriander to animal food reduces methane production by about 40%.

(a) (i) Why does adding coriander to an animal's food reduce methane production?

_____

_____

(1)

(ii) Explain **one** advantage to a farmer of adding coriander to the animal's food.

_____

_____

_____

_____

(2)

(b) Farm animals give off large amounts of methane.

Explain the effects of adding large amounts of methane to the atmosphere.

_____

_____

_____

_____

(3)
(Total 6 marks)

Q31.

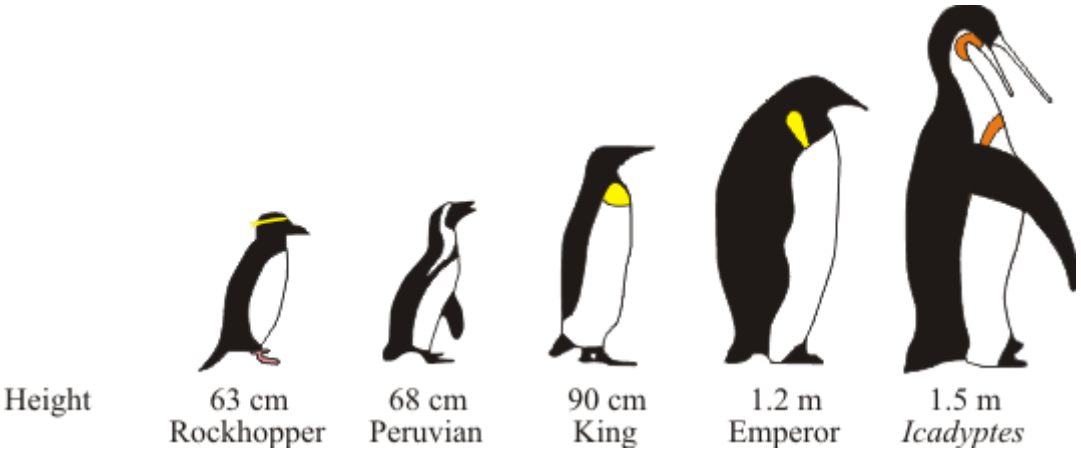
(a) Explain, as fully as you can, how natural selection leads to evolution.

(3)

(b) Most penguins live in cold climates. The modern penguin best adapted for cold conditions is the emperor penguin.

Scientists have found fossils of a 'giant' penguin which they have called *Icadyptes*.

The diagram shows how the size of modern penguins compares with *Icadyptes*.



The scientists were surprised to discover that *Icadyptes* lived in warm seas at a time when the Earth's climate was much warmer than it is now.

Explain why the scientists were surprised that *Icadyptes* lived in warm seas.

(2)

(Total 5 marks)

Q32.

Human activities affect the environment.

(a) Deforestation results in an increase in carbon dioxide levels in the atmosphere.

Give **two** reasons why.

(2)

(b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

A dairy farmer washes out his cow shed each day. The waste water contains urine and faeces. The waste water overflows into a stream by mistake.

The waste water will have an effect on the plants and invertebrates living in the stream.

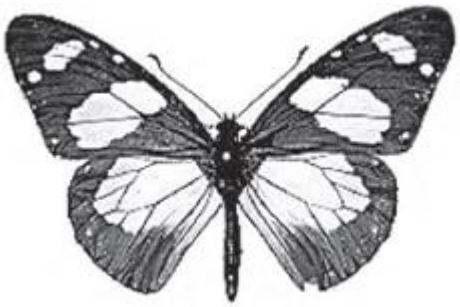
Explain why.

(6)

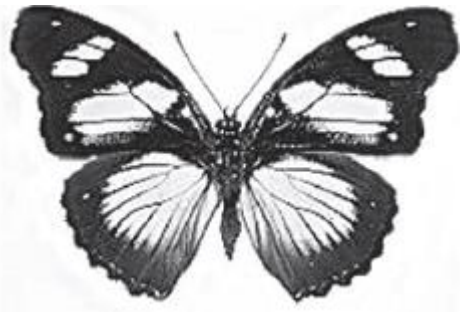
(Total 8 marks)

Q33.

The drawings show two different species of butterfly.



Amauris



Hypolimnas

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

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

(2)

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

_____

_____

_____

_____

_____

_____

(3)

(Total 5 marks)

Q34.

In January 2011 more than 600 000 people collected results for the UK national bird survey.

People recorded the number of each species of bird they saw in 1 hour on 1 day in their garden.

Some of the results are shown in the table below.

Species	**Mean number of birds seen per garden**	**Percentage of gardens in which the bird was seen**
House sparrow	4.1	64.5
Starling	3.9	51.3
Blackbird	3.2	95.2
Goldfinch	1.5	33.5

(a) A student looked at the table and said:

"In the UK, house sparrows are more common than blackbirds."

Suggest **three** reasons why the student's statement may **not** be true.

_____

_____

_____

_____

_____

_____

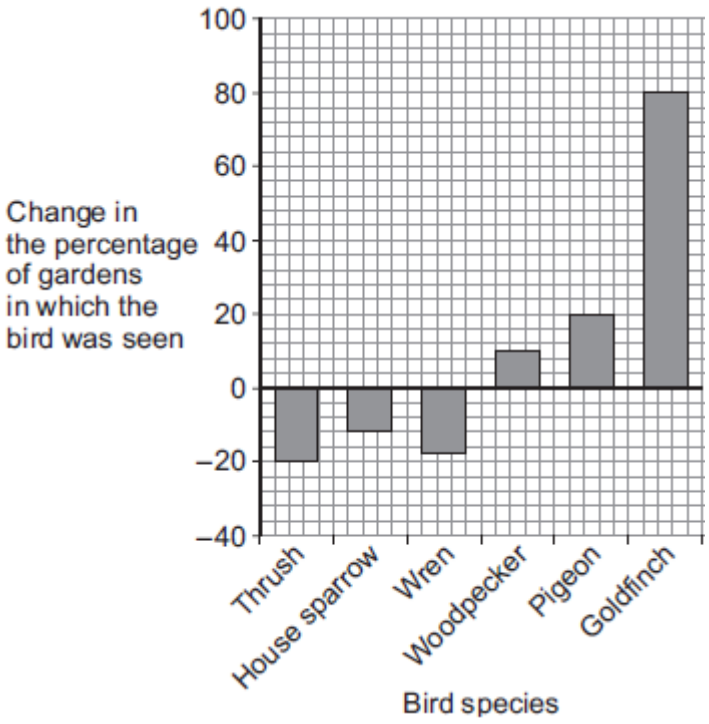
_____

_____

(3)

(b) A survey in 2012 was done in the same way as the 2011 survey.

The graph below shows changes in the percentages of gardens in which some birds were seen from 2011 to 2012.



(i) Calculate the percentage of gardens in which goldfinches were seen in 2012.

Use information from the graph and the table.

_____

_____

Answer = _____ %

(2)

(ii) Suggest **two** reasons why goldfinches were seen in more gardens in 2012 than in 2011.

_____

_____

_____

_____

(2)

(Total 7 marks)

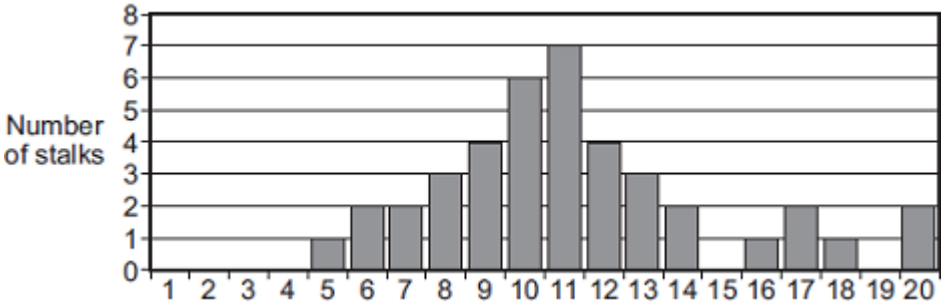
Q35.

Some students studied bluebell plants growing in two different habitats.

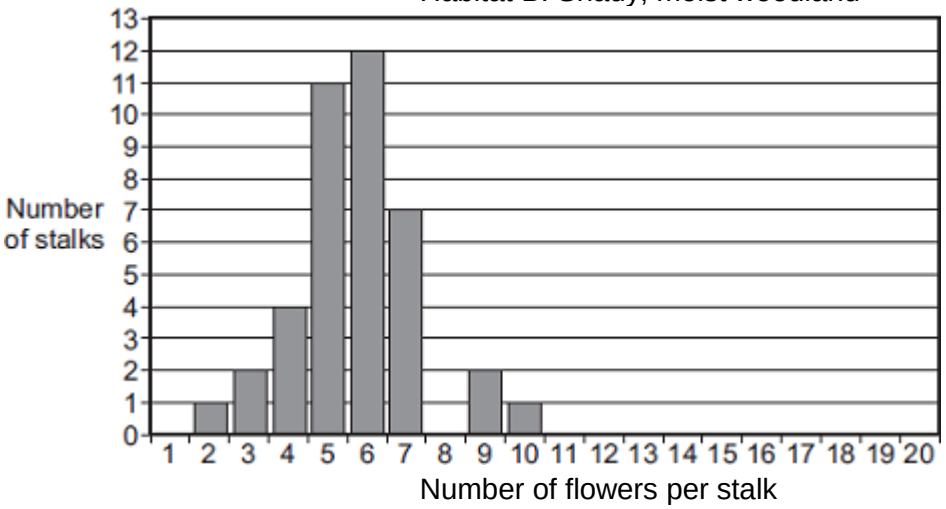
Habitat **A** was a sunny field next to woodland.
Habitat **B** was a shady, moist woodland.

A bluebell plant can have several flowers on one flower stalk. The students counted the number of flowers on each of 40 bluebell flower stalks growing in each habitat.
The bar charts show the results.

Habitat A: Sunny field next to woodland



Habitat B: Shady, moist woodland



(a) The students wanted to collect valid data.
Describe how the students should have sampled the bluebell plants at each habitat to collect valid data.

_____

_____

_____

_____

_____

(2)

(b) (i) The students used the bar charts to find the mode for the number of flowers per stalk in the two habitats.

The mode for the number of flowers per stalk in habitat **A** was 11.

What was the mode for the number of flowers per stalk in habitat **B**?

Mode = _____

(1)

(ii) The students suggested the following hypothesis:

'The difference in the modes is due to the plants receiving different amounts of sunlight.'

Suggest why.

_____

_____

_____

_____

(2)

(iii) Suggest how the students could test their hypothesis for the two habitats.

_____

_____

_____

_____

(2)

(c) Suggest how receiving more sunlight could result in the plants producing more flowers per stalk.

_____

_____

_____

_____

(2)

(Total 9 marks)

Q36.

Darwin suggested the theory of natural selection.

(a) Explain how natural selection occurs.

_____

_____

_____

_____

_____

_____

(3)

(b) Latitude is a measure of distance from the Earth's equator.

Scientists investigated the effect of latitude on:

- the time taken for new species to evolve
- the number of living species.

The table shows the scientists' results.

Latitude in degrees North of equator	Time taken for new species to evolve in millions of years	Relative number of living species
0 (at the equator)	3–4	100
25	2	80
50	1	30
75 (in the Arctic)	0.5	20

As latitude increases environmental conditions become more severe.

(i) Describe the patterns shown by the data.

(2)

(ii) Suggest explanations for the patterns you have described in part (b)(i).

(2)

(Total 7 marks)

Q37.

The photographs show four different species of bird.

Great tit

© JensGade/iStock

Blue tit

© Marcobarone/iStock

Coal tit

© MikeLane45/iStock

Long-tailed tit

© Andrew Howe/iStock

The table gives information about the four species of bird in winter.

Bird species	Mean body mass in grams	Mean energy needed in kJ per day	Mean percentage of day spent feeding
Great tit	21	84.2	75
Blue tit	12	62.4	81
Coal tit	9	49.5	88
Lond-tailed tit	7	42.0	92

(a) (i) Calculate the energy needed per day per gram of body mass for the blue tit.

_____

_____

_____

Answer = _____ kJ per day per gram of body mass

(2)

(ii) Describe the trend for energy needed per day per gram of body mass for the four species of bird.

_____

_____

_____

(1)

(iii) Suggest an explanation for the trend you have described in part (a)(ii).

_____

_____

_____

_____

(2)

(b) Describe and explain the trend shown by the data for the time spent feeding in winter for the birds.

_____

_____

_____

_____

(2)

(Total 7 marks)

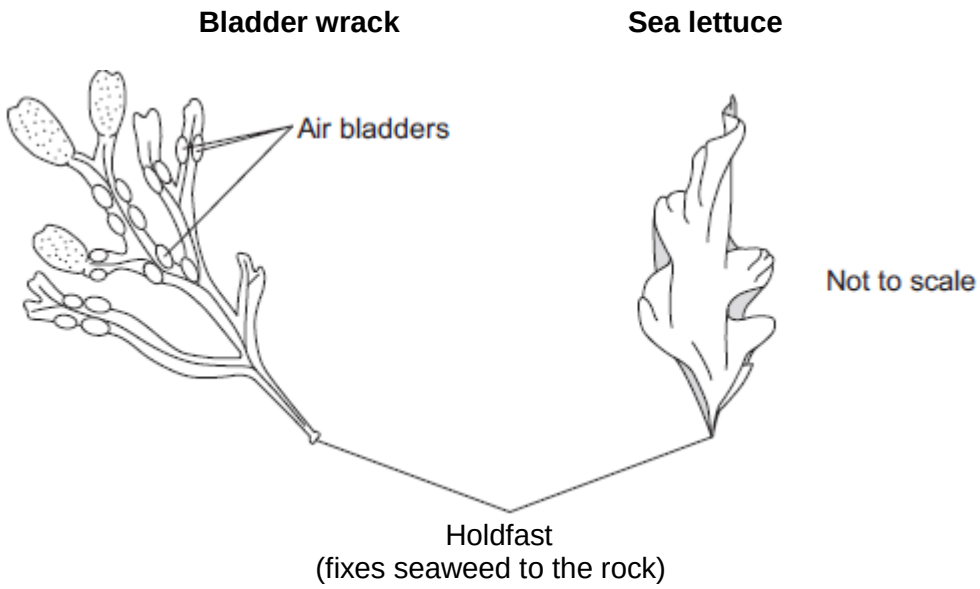
Q38.

At the seashore, the tide comes in and goes out twice each day.

Some students investigated whether two different species of seaweed could live only at certain positions on a rocky shore.
Seaweeds are plant-like organisms that make their food by photosynthesis.

Figure 1 shows the two species of seaweed that the students investigated.

Figure 1



(a) The students:

1 placed a 50-metre tape measure on the rocks at right angles to the sea

2 placed a quadrat next to the tape measure

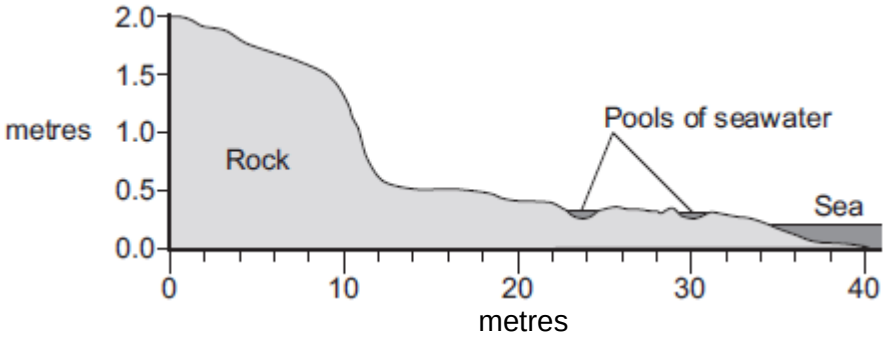
3 recorded whether each species was present or not.

The students repeated steps 2 and 3 every metre down the shore.

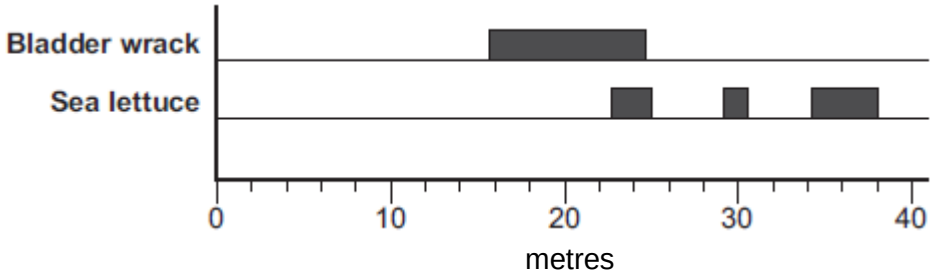
Figure 2 shows a section of the seashore and the students' results.

Figure 2

Section of the seashore



Students' results



(i) The students placed the quadrat at regular intervals along a transect line rather than placing the quadrat at random positions anywhere on the rocky shore.

Explain why.

_____

_____

_____

_____

(2)

(ii) How could the students have improved their investigation to ensure that they produced valid data?

_____

_____

_____

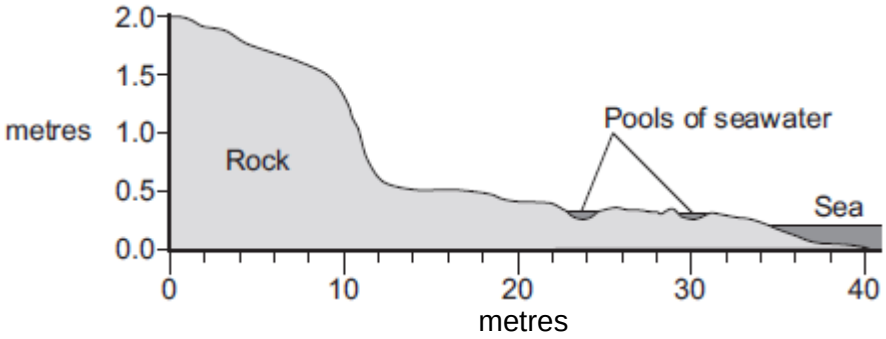
_____

(2)

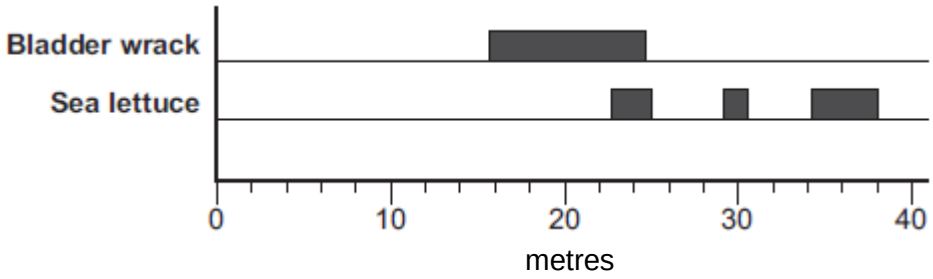
(iii) **Figure 2** is repeated here to help you answer this question.

Figure 2

Section of the seashore



Students' results



The students concluded that bladder wrack is better adapted than sea lettuce to survive in dry conditions.

What is the evidence for this conclusion?

Use information from **Figure 2**.

_____

_____

_____

_____

(2)

(b) The bladder wrack has many air bladders.
The air bladders help the bladder wrack to float upwards when the sea covers it.

Suggest how this helps the bladder wrack to survive.

_____

_____

_____

_____

(2)

(Total 8 marks)

Q39.

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.

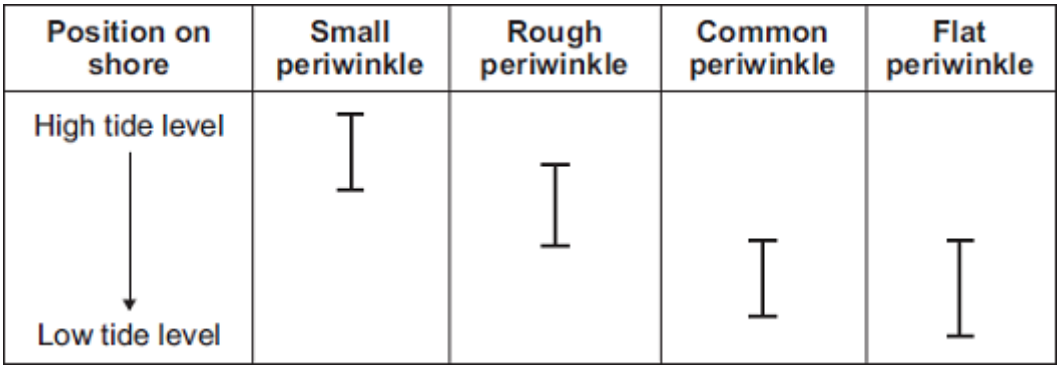
What term is used to describe organisms that can survive in severe conditions such as very high concentrations of salt solution?

_____

(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.



(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).

_____

_____

(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. _____

_____

_____

2. _____

_____

_____

(2)

(Total 5 marks)

Mark schemes

Q1.

(a) reduces biodiversity

1

peat is being used faster than it forms

allow peat is non-renewable

1

(b) decay / decomposition / rotting of peat

1

by microorganisms / bacteria / microbes / fungi / decomposers introduced when peat is mixed with air

1

that respire using substances in peat as reactant

1

and using oxygen that is introduced when peat is mixed with air

1

[6]

Q2.

(a) guard cell

ignore stoma / stomata

1

(b) Species A :

allow converse points for species B

stomata open in dark / at night **or** close in light / in day

1

stomata closed during warm(est) period **or** open when cool(er)

1

heat (energy) /warmth increases evaporation / transpiration

must give explicit link between heat and transpiration

1

reduces water loss / evaporation / transpiration

ignore photosynthesis

1

[5]

Q3.

plants absorb CO_2 for photosynthesis

ignore carbon

1

all organisms / any named organism respire(s) and release(s) CO_2

ignore breathing

ignore carbon

1

any **four** from:

- carbon compounds / named compound made by plants
- plants eaten by animals
- dead organisms / faeces are decomposed / decayed
  allow broken down
- by bacteria / microorganisms
- dead plants and animals (may) form fossil fuels
- when (fossil) fuels are burnt they release CO_2 into the air

4

[6]

Q4.

read 'the gas' or 'it' as carbon dioxide

(plants) photosynthesise

1

(plants) absorb <u>carbon dioxide / CO_2</u> (from the air)
allow take in / use <u>carbon dioxide / CO_2</u> (from the air)

1

(overall) <u>more carbon dioxide / CO_2</u> is being released into the air than is being removed
*allow 470 (billion tonnes) released **but / and** 450 (billion tonnes) taken in*

1

(by) <u>respiration</u> (by all organisms / any named organism)
ignore breathing
ignore carbon

1

(and) combustion / burning
ignore carbon

1

(so) amount of <u>carbon dioxide / CO_2</u> in air is increasing
allow 20 (billion tonnes) of <u>carbon dioxide / CO_2</u> added to air each year

1

[6]

Q5.

(a) the birds now arrive earlier (in the UK)
must imply both species of birds

1

the Sand martin (now) arrives before the Barn swallow
or
the Barn swallow (now) arrives later than the Sand martin
or
arrival time of the two birds has reversed

1

(b) any **two** from:

- warmer in UK <u>earlier</u> (in year)
  or
  colder abroad <u>earlier</u> (in year)
  allow too hot / cold abroad <u>earlier</u> (in year)
  ignore global warming

- insects / food appears <u>earlier</u> (in year in UK)
  or
  shortage of insects / food abroad <u>earlier</u> (in year)
  accept feasible reference to competition for food

- new genes / mutation
  allow evolution / natural selection
  ignore adapted
  ignore pollution

2

[4]

Q6.

reduces landfill
accept reduces pollution from burning wastes
ignore less waste unqualified

1

scheme self-financing
or
produces compost / fertiliser which can be sold

1

produces nutrients / fertiliser / minerals (ions) for plants
allow returns / recycles nutrients into soil
ignore helps plants grow

1

[3]

Q7.

(a) *idea:*
more (fossil) fuel burned (do not credit simply more people/cars/industry)
deforestation = less photosynthesis
deforestation = more respiration/burning
each for 1 mark

3

(b) *idea*:
climate change
for 1 mark

warmer/colder/drier/wetter
food production affected/starvation
mayor ecosystems destroyed/damaged
any two for 1 mark each

sea level rise

for 1 mark

low land flooded
less food grown/starvation
homes/factories flooded

any two for 1 mark each

Allow
polar ice caps melt
sea water expands

[9]

Q8.

(a) (sensor used by Group 2) had lower resolution

accept converse answers

allow poor / worse resolution

allow (sensor used by Group 2) only measured to whole numbers

ignore reference to sensitivity / precision / accuracy

1

(b) microorganisms / bacteria (in water / from sewage)

ignore references to plants

1

used up oxygen

must be linked to microorganisms

1

during respiration

1

(c) freshwater louse

*correct organism **and** reason needed for mark*

allow louse / lice

number of organisms changes little

1

[5]

Q9.

(a) microorganisms / bacteria / fungi

allow correct named organisms

allow detritus feeders / decomposers / worms

1

break down / digest / feed on (dead organisms)

accept use carbohydrates / glucose

allow decomposes

ignore decay / rot

1

(and release carbon dioxide when they) <u>respire</u>

*do **not** allow respiration if linked to leaves / dead organisms*

1

(b) any **two** from:

- the higher the temperature the faster the rate of decay

  allow faster / more carbon dioxide for faster rate of decay
- the higher the oxygen concentration the faster the rate of decay

  allow faster / more carbon dioxide for faster rate of decay
- the rate increases faster (with increasing oxygen concentration) at 20 °C (than 15 °C)

2

[5]

Q10.

any **six** from:

*only credit release of carbon dioxide **once** when linked to a correct process*

ignore references to burning

- (plants) photosynthesise
- *(plants)* take in carbon dioxide
- *(plants)* produce carbohydrates / fats / proteins

  accept produce glucose
- (carbon compounds transferred by) feeding
- respiration
- breaks down carbon compounds / carbohydrates

  accept glucose
- releases carbon dioxide
- organisms die / produce wastes / *excrete*
- (which are) decomposed / decayed by microorganisms

  allow broken down

  allow bacteria / fungi / microbes / decomposers
- (which) release carbon dioxide

[6]

Q11.

conclusion with relevant explanation:

for microorganisms allow microbes, bacteria or fungi

<u>Conclusion</u>

as temperature increases the rate of decay increases

may refer to A, B or both

1

<u>Explanation</u>

(because) microorganisms / enzymes are more active in warmer conditions

allow microorganisms reproduce quicker

1

<u>Conclusion</u>

(decay of) leaves from region B was affected more by temperature / increases more

rapidly with temperature

accept description of this eg below 26-28°C leaves from region B decay slower (than from region A), but above 26-28°C leaves from region B decay faster (than from region A)

1

Explanation

(because) there were different types of microorganisms on the leaves

allow (leaves from) different species of beech tree

allow difference in water content of leaves

ignore different levels of oxygen

*allow rate of decay of leaves from both regions the same at 26-28°**C** for **1** mark, if no other conclusions made*

if incorrect / incomplete conclusion ignore explanation

1

[4]

Q12.

(a) any **two** from:

- disposes of his kitchen waste
- releases nutrients for his plants
- saves him money on fertiliser
- improves soil structure.

allow will help his plants / vegetables to grow

2

(b) any **three** from:

- earthworms allow (more) air / oxygen to enter
- earthworms break wastes into small(er) pieces

accept earthworms increase surface area of wastes

- plastic sheet keeps the heap warm
- plastic sheet keeps in water
- microorganisms / bacteria / fungi cause decay / breakdown / decomposition / digestion (of waste)

allow decomposers

ignore detritivores / earthworms

- (microorganisms / bacteria / fungi) are more active / digest / breakdown materials faster in warm / moist / aerobic conditions.

*need reference to earthworms **and** sheet for full marks*

*allow decomposers rate must be linked to microorganism **and** a factor*

3

[5]

Q13.

(a) *idea:*

soil wetter
soil less aerated
less food for moles/voles/foxes/badgers/birds
soil less fertile (less leaves in soil <u>not</u> enough on its own)
less food grown
earthworms die out/fewer earthworms
(<u>not</u> just “earthworms get eaten”)

any 4 for 1 mark each

4

(b) method
advantage
disadvantage
*e.g.**

- chemical
- kills worm/affects reproduction/maintains earthworm population
- persistent/food chain/kill earthworm

or

- import biological central/predator/disease/parasite
- kills worm/affects reproduction/maintains earthworm population
- may attack other animals/cause same sort of problems as New Zealand worms

(* credit other plausible suggestions for method/advantage/disadvantage)
for 1 mark each

3

[7]

Q14.

(a) stays cool
ignore shade

1

less sweat

1

(b) any **two** from:

- breathing rate less
- less water lost via breath
less can be implied
- less water <u>from</u> respiration

2

[4]

Q15.

idea

- banded snails camouflaged/less easily seen
- fewer banded eaten [by birds]
- more banded survive <u>to breed</u>
- more genes for banded passed on
or more banded snails in population

for 1 mark each

N.B.
Accept reverse of all above for plain snails
*All 4 marks may be gained by a relatively short response

[4]

Q16.

(a) idea

- unbanded dominant/plain **or** banded recessive
- because banded appears in young/
- parents heterozygous/Bb
- offspring BB } credit response consistent with parents
  Bb } even if not both heterozygous
  Bb }
  bb }

  Accept any clear and consistently used notation
- identify BB, Bb as plain
- identify bb as banded
- ratio 3:1 unbanded/banded (stated or clearly implied
- matches 35:12 results e.g. all the outcomes clearly identified as banded/unbanded)

  for 1 mark each

7

(b) *idea*

- many genes control [accept "continuous variation"]
- many alleles for a gene/large genepool
- snails can inherit lots of different combinations
- mutation (gives rise to many alleles)
  allow selection allows alleles to be passed on unless [very]disadvantageous or if advantageous

  any 4 for 1 mark each

  [Also credit, for 1 mark each, up to 2 causes of mutation, e.g. mistakes in cell division, radiation]

4

[11]

Q17.

(i) 0.25 × 100 / 25

gains 1 mark

but
1%

gains 2 *marks*

2

(ii) muscle contraction / limb movement / moving around / chewing
heartbeat / breathing / internal muscle activity
maintaining body temperature / keeps body warm
active uptake synthesising substances (*reject* growth)

any three for 1 mark each

3

[5]

Q18.

(a) diatoms photosynthesise **or** are producers

1

the amount of growth depends upon the energy **or** light they get

accept more light means more growth
or *they multiply more in more light*
do not accept they need light

1

(b) (i) eaten by small fish

do not accept eaten by fish

1

minerals **or** nitrate **or** phosphates
or nutrients **or** food supply used up
or reduced

1

(ii) any **two** from

gets colder
light decreases
end of their life span **or** die

accept more being eaten than being formed

eaten by small fish

do not accept a decrease in nitrates
or *phosphates*

1

(c) increased minerals **or** nitrates **or** phosphates

1

any **one** from

due to death **or** decay of diatoms **or** fish

do not accept death of large fish

1

influx of minerals in an ocean current

do not accept extraneous pollution ***or***
dumping by a ship

1

[8]

Q19.

(a) 3060 (kJ)

1

(b) (i) 22060 (kJ)

1

(ii) photosynthesis

1

(c) faeces / undigested food

reference to movement and respiration are neutral

urine / urea

2

accept excretion / waste / droppings if
<u>both</u> of the mark points are not gained

(d) any **two** from

- control ripening
- herbicides
- prevent over ripening in transport
- stimulate root growth

other growth references are not neutral

- use in tissue culture to produce large numbers of plantlets

2

[7]

Q20.

<u>pros e.g.:</u>

gum trees survive therefore less soil erosion
therefore food webs not disrupted
if no culling, whole Koala population may die
easier to cull because Koalas are difficult to catch

<u>cons e.g.:</u>

Koala's 'right to life' / ethical issue
better to transfer to reserves on mainland than kill
could use tranquillisers to catch without killing
could allow population to stabilise naturally

max 4 of the above; max 3 pros or cons.

[4]

Q21.

(a) wing pattern similar to *Amauris*

1

birds assume it will have foul taste

1

(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

[5]

Q22.

Cogently argued based on biological principles, for **and**
against introduction of caterpillar
maximum of 4 pros e.g.
fewer chemicals used therefore less expense
less chemical damage to other plants
consequent benefits to food chains
fewer farm animals poisoned therefore more economic
countryside more varied therefore more attractive to tourists
tourists bring economic advantages
greater variety of habitats therefore greater variety of species

any 4 for 1 mark each

4

cons e.g.
danger to livelihoods if crops destroyed by caterpillar
relatively low chance of success since only one third of schemes effective world-wide
unlikely to be natural predators therefore ecological balance affected

any 2 for 1 mark each

2

cogently argued case **gains up to 2 marks**

2

[8]

Q23.

(a) increased human population
increased standard of living

each for 1 mark

2

(b) nutrients absorbed by plants not replaced

each for 1 mark

2

(c) increased release of carbon dioxide into atmosphere when trees are burned
reduced rate of carbon dioxide removal from atmosphere
increased carbon dioxide absorbs more of energy radiated by Earth
global rise in temperature

each for 1 mark

4

[8]

Q24.

(a) light and/or temperature too low in winter,
increasing light in spring leads to increase in photosynthesis
increasing temperature in spring leads to increasing metabolism/ growth/reproduction

for 1 mark each

3

(b) they run out of minerals

for 1 mark

1

[4]

Q25.

(a) e.g.
timber
agriculture
roads / urban development / buildings

any two for 1 mark each

2

(b) *ideas that (accept reverse arguments)*
increased carbon dioxide content since less during photosynthesis and locked-up as wood burning increases carbon dioxide content
increased activity of microbes increases carbon dioxide content
oxygen content reduced water vapour content reduced

any five for 1 mark each

5

[7]

Q26.

any **three** from adaptation **and** effect:

ignore references to ions throughout ignore animals eating plant

few leaves / no leaves / little growth above ground / low surface area above ground so less water loss

*do **not** accept zero water loss*

deep roots

so can reach water **or** because surface soil is likely to dry out

accept 'moisture' for water

roots near surface so can obtain water when it does rain

widespread roots or many roots so can obtain water from a large area

swollen stem so can store water

[3]

Q27.

(a) Scotland

1

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 / $\frac{2.8}{21}$

1

(b) (i) broadleaf woodlands have more grey squirrels **or** broadleaf woodlands have less red squirrels

allow converse referring to conifers

1

(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

1

(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)

3

[7]

Q28.

(a) e.g.:
competition for light because potamogeton plants taller
competition for nutrients taller plants may have longer roots

each for 1 mark

4

(b) descriptions of:
measuring tape or similar quadrat
method of estimating cover (inside quadrat)

each for 1 mark

3

[7]

Q29.

Level 3 (5–6 marks):
A full explanation is given that is coherent and logically structured, linking effect of increase in carbon dioxide to climate change and effects on biodiversity.

Level 2 (3–4 marks):
An attempt is made to link the effects of rising carbon dioxide levels to climate change and biodiversity. The logic may be inconsistent at times but builds towards a coherent explanation.

Level 1 (1–2 marks):
Discrete relevant points made. The logic may be unclear and attempts at reasoning may not be consistent.

0 marks:
No relevant content.

Indicative content

- rise in carbon dioxide increases atmospheric temperature / causes global warming
- global warming causes extreme weather patterns
- such as rise in sea levels
- increased or decreased rainfall
- frequency of storms / droughts
- rise in sea levels means habitats will change due to flooding
- rise in sea levels could increase salt in soil
- increased rainfall will increase water levels
- severity of storms / droughts could affect photosynthesis
- consequences of changes are loss of or damage to habitats
- which will affect animal and plant distributions
- by increasing migration or species dying off
- which decreases biodiversity

[6]

Q30.

(a) (i) kills / gets rid of / reduces <u>methane</u> bacteria

allow kills / gets rid of / reduces <u>bad</u> bacteria

ignore acts like antibiotic

1

(ii) less food converted to methane

allow can keep more cattle without further environmental damage

ignore energy

1

more growth / meat / muscle / milk produced / more profit / fatter animals

ignore references to bacteria and disease

1

(b) absorbs energy / heat radiated by Earth

allow absorbs / traps energy / heat / from Earth

*do **not** allow absorbs energy / heat from Sun*

1

some energy / heat reradiated

ignore reflected

*do **not** allow reradiates energy / heat from Sun*

1

leading to global warming / enhanced greenhouse effect

accept effects of global warming eg melting ice caps

accept methane is a greenhouse gas

ignore references to ozone

1

[6]

Q31.

(a) variation / mutation

1

individuals with characteristics most suited to environment survive

allow survival of the fittest

1

genes passed to next generation **or** these individuals reproduce

1

(b) any **two** from:

- similar in size to Emperor penguin **or** bigger than all penguins
- large size is adaptation to cold climate
- since less heat loss per unit of body volume **or** smaller surface area / volume ratio

2

[5]

Q32.

(a) any **two** from:

- fewer trees to take in carbon dioxide for photosynthesis
- decomposers / microorganisms respire (as they decay debris) releasing carbon dioxide
- burning of wood releases carbon dioxide

allow carbon dioxide released by burning fossil fuels in vehicles / factories

2

(b) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best − fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1 − 2 marks)
There is a brief description of some steps in the process but the order is not clear with little biological vocabulary used.

Level 2 (3 − 4 marks)
There is a reasonably clear description of the process involving many of the steps and using some biological vocabulary.

Level 3 (5 − 6 marks)
There is a clear, logical and detailed scientific description of the process using

appropriate biological vocabulary.

examples of biology points made in the response:

- this contains mineral ions (and organic matter)
- this increases growth of algae / water plants
- the plants / algae (underneath) die
- due to lack of light / photosynthesis / space
- decomposers / microorganisms feed on decaying matter **or** multiply rapidly
- the respiration of decomposers uses up all the oxygen
- so invertebrates die due to lack of oxygen
- this is called eutrophication

6

[8]

Q33.

(a) wing pattern similar to *Amauris*

allow looks similar to Amauris

1

birds assume it will have an unpleasant taste

1

(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 not eaten (by birds)

1

these butterflies breed **or** their genes are passed to the next generation

1

[5]

Q34.

(a) any **three** from:

- blackbirds seen in higher % of / more gardens
- multiplying mean number by percentage of gardens seen in shows blackbird is higher

  *allow **1** additional mark for correct figures showing this, ie 264 sparrows: 305 blackbirds*
- only done on one day / month / hour

  eg only done in January
- only done in gardens (one bird may prefer a different habitat)
- problem of (correct) identification
- may re-count same ones

  if neither point 5 or 6 given allow 1 mark for idea of error / miscounted
- people may quote false numbers / may make it up

3

(b) (i) 60.3

*award **2** marks for correct answer, irrespective of working*

*award **1** mark for 33.5 + (33.5 × 80 / 100) or equivalent with no answer or incorrect answer **or** award **1** mark for 26.8*

2

(ii) any **two** from:

- change in temperature

  a comparison is required

  eg cooler / warmer / less frost (in 2012)

- fewer predators
- more food **or** less competition for food
- more nesting space **or** less competition for nesting space
- less disease (in 2012)

  allow idea that people may be better / worse at identifying birds / goldfinches

  allow idea of movement to gardens (due to poor food supply elsewhere)

2

[7]

Q35.

(a) use of quadrat / point frame

allow description

1

<u>randomly</u> placed / <u>random</u> sampling

ignore reference to transects

1

(b) (i) 6

1

(ii) more <u>light</u> in A / in field / where sunny

ignore sun

1

more / better / faster photosynthesis in A / with more light

allow converse

1

(iii) use light meter / measure light <u>intensity</u> in both habitats

1

take many measurements at same time of the day

1

or

laboratory / field investigation with 2 batches high light and low light (1)

count or number of flowers in each (1)

counting point is dependent on investigation point

(c) more glucose / energy available

allow other named product eg protein

allow if more energy produced

1

for growth

dependent on 1st mark

1

[9]

Q36.

(a) variation (between organisms within species)

allow described example

*allow mutation – but **not** if caused by change in conditions*

1

those most suited / fittest survive

1

genes / alleles passed on (to offspring / next generation)

allow mutation passed on

1

(b) (i) any **two** from:

allow converse

- increase in latitude reduces number of (living) species
  ignore references to severity of conditions
- increase in latitude reduces time for evolution (of new species)
- the less the time to evolve the fewer the number of (living) species

2

(ii) any **two** from:

*do **not** accept intention or need to evolve*

- (increase in latitude reduces number of (living) species because) less food / habitats / more competition <u>at high latitude</u>
  allow only extremophiles / well-adapted species can survive
- (increase in latitude reduces time for evolution (of new species) because) severe conditions act more quickly / to a greater extent on the weakest
- (the less the time to evolve the fewer the number of (living) species because) species that evolve slowly don't survive

2

[7]

Q37.

(a) (i) 5.2

*award **2** marks for correct answer, irrespective of working or lack of it*

*award **1** mark for 62.4 ÷ 12 only with incorrect or no answer*

2

(ii) the smaller the (mass of the) bird the more energy is needed (per gram of body mass)

allow converse

ignore figures

1

(iii) smaller bird has larger surface area : volume / mass ratio

allow converse

1

so heat / energy lost more quickly

allow lose more heat / energy

*if (a)(ii) describes a trend of more energy with increasing body mass allow **one** mark for idea of more energy needed for flight*

1

(b) larger birds spend less time feeding

accept converse

allow the less energy they need per day the longer they spend feeding

1

since they need less food per gram of body mass (to satisfy energy needs)

1

[7]

Q38.

(a) (i) to get data re position of seaweed / of organism

1

in relation to distance from sea / distance down shore / how long each seaweed was exposed

1

(ii) repeat several times

minimum = 2 repeats

1

elsewhere along the shore

1

(iii) bladder wrack is further up the shore (than the sea lettuce) / exposed for longer

ignore found in dry areas / on bare rock

1

sea lettuce (only) in rock pools / in the sea / (only) in water

1

(b) gets more light / closer to light

allow better access to CO_2

1

(so) more photosynthesis

allow 1 mark for light for photosynthesis

allow 1 mark for CO_2 for photosynthesis

ignore reference to oxygen for respiration

'more' only needed once for 2 marks

1

[8]

Q39.

(a) extremophile(s)

1

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

*either order, **both** required*

1

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

allow habitats overlap the most

1

(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

2

[5]