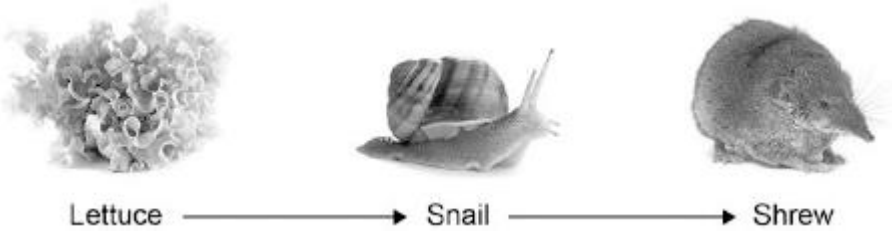
ADAPTATIONS, INTERDEPENDENCE AND COMPETITION PART I

Q1.

The diagram below shows a food chain in a garden.



Lettuce © destillat/iStock/Thinkstock; Snail ©Valengilda/iStock/Thinkstock; Shrew © GlobalT/iStock/Thinkstock

(a) Name **one consumer** shown in the diagram above.

_____

(1)

(b) Name **one carnivore** shown in the diagram above.

_____

(1)

(c) A disease kills most of the shrews in the garden.

Suggest why the number of snails in the garden may then increase.

_____

_____

(1)

(d) What is the name given to all the snails in the garden shown in the diagram above?

Tick **one** box.

Community ☐

Ecosystem ☐

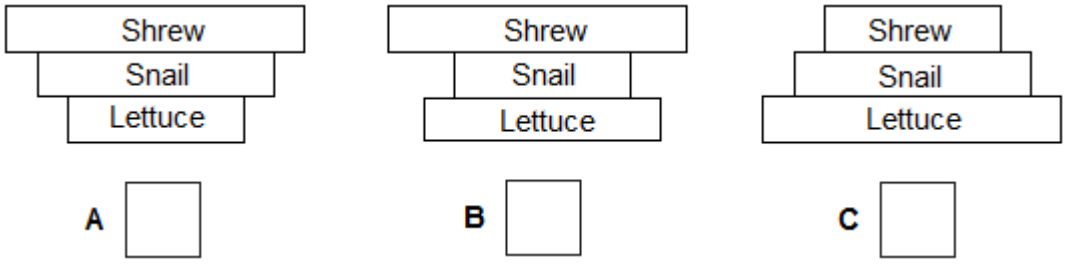
Population ☐

Territory ☐

(1)

(e) Which pyramid of biomass is correct for the food chain shown in the diagram above?

Tick **one** box.



A ☐ B ☐ C ☐

(1)

(f) Some snails ate some lettuces.

The lettuces contained 11 000 kJ of energy.

Only 10% of this energy was transferred to the snails.

Calculate the energy transferred to the snails from the lettuces.

_____

Energy = _____ kJ

(1)

(g) Give **one** reason why only 10% of the energy in the lettuces is transferred to the snails.

Tick **one** box.

The lettuces carry out photosynthesis ☐

The snails do not eat the roots of the lettuces ☐

Not all parts of a snail can be eaten ☐

(1)

(h) **Abiotic** factors can affect the food chain.

Wind direction is one abiotic factor.

Name **one other** abiotic factor.

_____

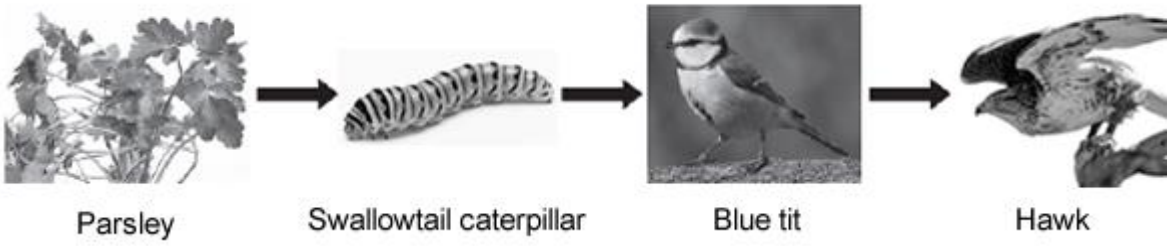
(1)

(Total 8 marks)

Q2.

Figure 1 shows how energy and biomass pass along a food chain.

Figure 1



(a) The parsley shown in **Figure 1** carries out photosynthesis.

_____

_____

_____

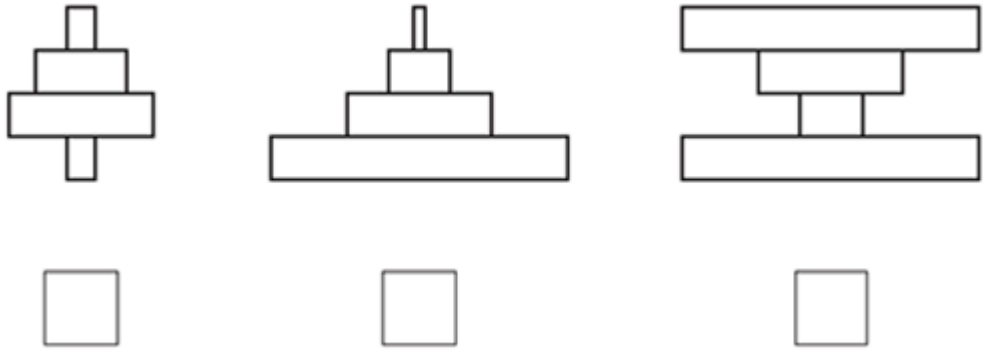
_____

(2)

(b) Which diagram shows the pyramid of biomass for the food chain in **Figure 1**?

Why is photosynthesis important in the food chain?

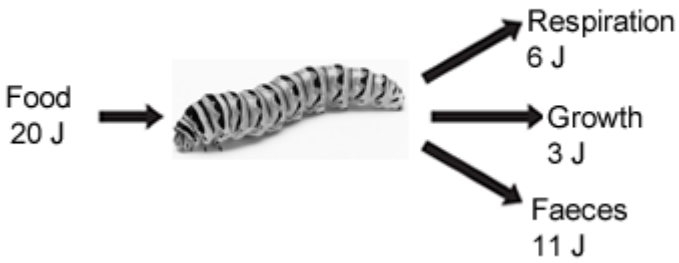
Tick (✔) **one** box.



(1)

(c) **Figure 2** shows the ways a swallowtail caterpillar transfers 20 J of energy from food.

Figure 2



What percentage of the energy in the caterpillar's food is used for growth?

_____

_____

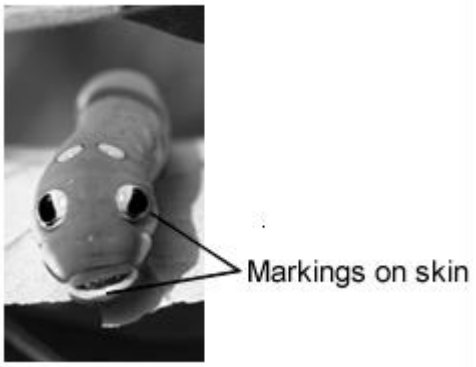
Percentage = _____

(2)

(d) The organisms in the food chain are adapted for survival.

(i) **Figure 3** shows a swallowtail caterpillar seen from the back.

Figure 3



Suggest how the swallowtail caterpillar shown in **Figure 3** is adapted to reduce the chance of being eaten by blue tits.

_____

_____

_____

_____

(2)

(ii) **Figure 4** shows a hawk.

Figure 4

Suggest **two** ways that the hawk is adapted to catch and kill blue tits.

1. _____

_____

2. _____

_____

(2)
(Total 9 marks)

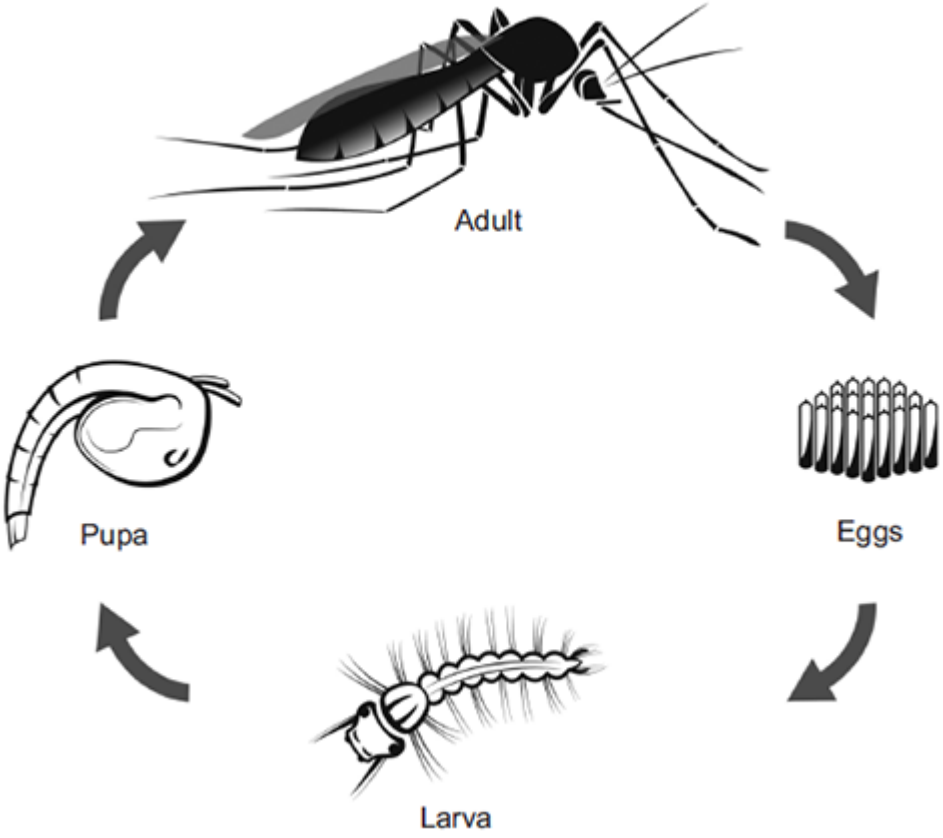
Blue tit: ©JensGade/iStock
Parsley: © Warren_Price/iStock
Caterpillar ©prettyzhizhi/iStock
Hawk: © kojihirano/iStock
Swallowtail caterpillar: © Anna_Po/iStock

Q3.

Malaria is a disease caused by a microorganism carried by mosquitoes.

The microorganism is transferred to humans when adult female mosquitoes feed on human blood.

The figure below shows the life cycle of a mosquito.



© watcharapon/iStock

The World Health Organisation estimates that 3×10^8 people are infected with malaria every year.

Scientists estimate that malaria kills 2×10^6 people every year.

The people who are infected with malaria but do not die, may be seriously ill and need health care for the rest of their lives.

(a) Based on the estimated figures, what percentage of people infected with malaria die from the disease?

_____

_____

_____

_____

(2)

(b) An internet article states:

1 Mosquito larvae are at the start of the food chain for some fish.
2 Adult mosquitoes provide food for bats and birds.
3 Mosquitoes are also important in plant reproduction because they feed from flowers of crop plants.

(i) The first sentence in the article is **not** correct.

Explain why.

_____

_____

_____

_____

(2)

(ii) A company plans to produce genetically modified (GM) adult male mosquitoes.
The GM mosquitoes will carry a gene from bacteria. The gene causes the death of offspring before they become adults.

Male mosquitoes do **not** feed on blood.
Scientists are considering releasing millions of adult male GM mosquitoes into the wild.

Do you think scientists should release millions of male GM mosquitoes into the wild?

In your answer you should give advantages and disadvantages of releasing GM mosquitoes into the wild.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(iii) Describe the process for creating a GM mosquito.

_____

_____

_____

_____

_____

_____

(3)

(Total 11 marks)

Q4.

Students investigated a food chain in a garden.

lettuce ⟶ snail ⟶ thrush (bird)

The students:

- estimated the number of lettuce plants in the garden
- estimated the number of snails feeding on the lettuces
- counted two thrushes in the garden in 5 hours.

The table below shows the students' results and calculations.

Organism	Population size	Mean mass of each organism in g	Biomass of population in g	Biomass from previous organism that is lost in g	Percentage of biomass lost
Lettuce	50	120.0	6000		
Snail	200	2.5	500	5500	91
Thrush	2	85.0	170	330	66

(a) (i) Give **two** ways that biomass is lost along a food chain.

_____

_____

_____

_____

(2)

(ii) Scientists estimate that about 90% of the biomass in food is lost at each step in a food chain.

Suggest **one** reason why the students' value for the percentage of biomass lost between the snails and the thrushes is only 66%.

_____

_____

(1)

(b) European banded snails have shells with different colours (light or dark) and with stripes or with no stripes.

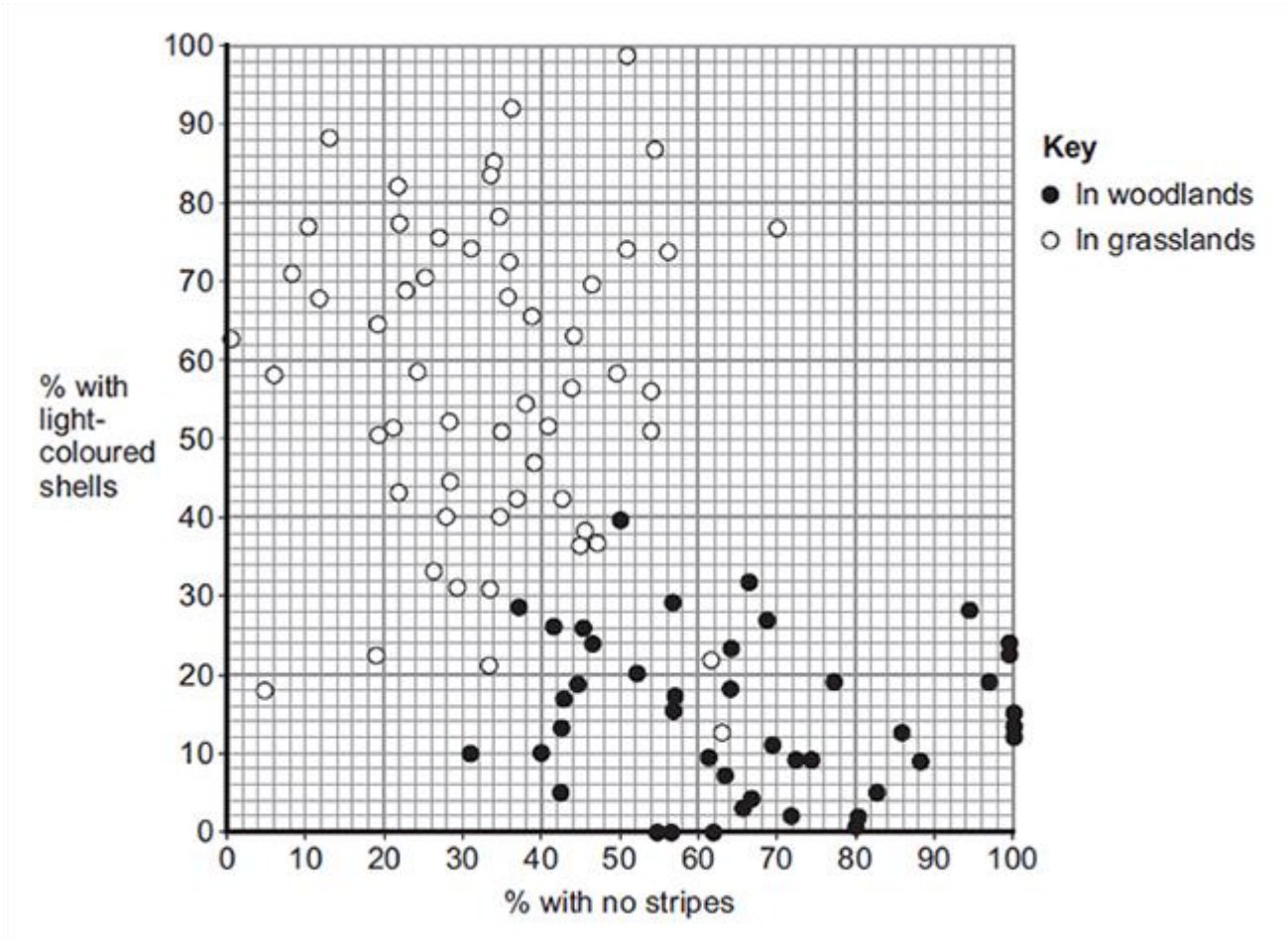
Figure 1 shows two examples of European banded snails.

Figure 1

Figure 2 shows results from surveys in woodlands and in grasslands of the percentage of snails with light-coloured shells and the percentage of snails with no stripes.

Each point on the graph represents the results of one survey in one habitat.

Figure 2



(i) **Figure 2** is a scatter graph.

Why is a scatter graph used for this data?

_____

_____

(1)

(ii) Compare the general appearance of snails that live in woodlands with the general appearance of snails that live in grasslands.

_____

_____

_____

_____

(2)

(iii) Suggest a reason for the general appearance of snails that live in woodlands.

_____

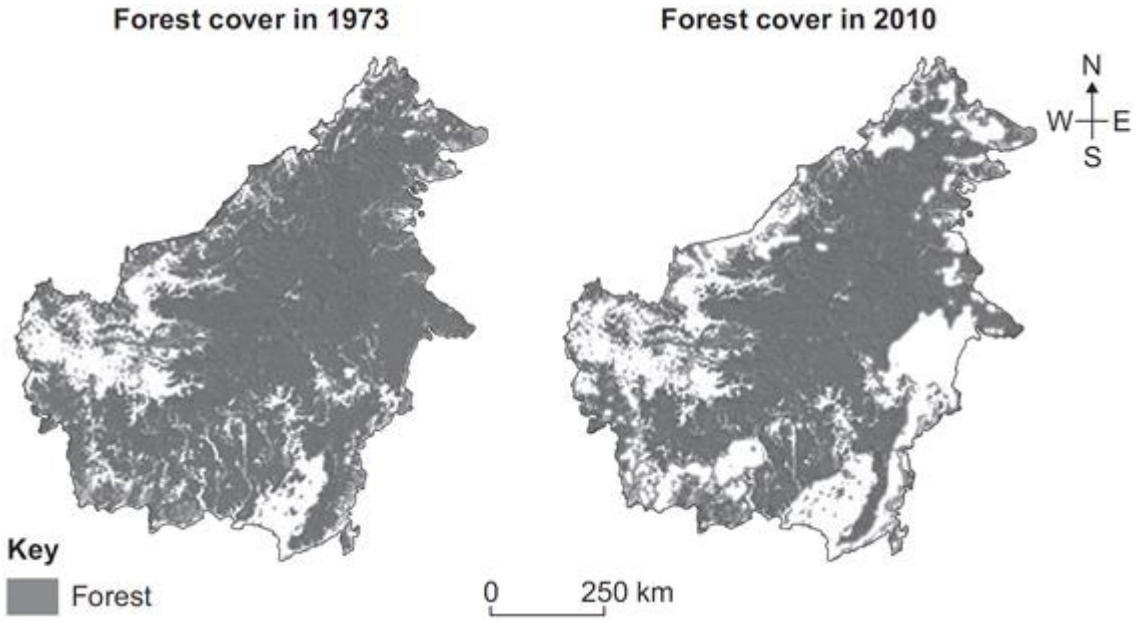
_____

(1)

(Total 7 marks)

Q5.

The figure below shows the amount of forest cover on an island in Asia, in 1973 and in 2010.



(a) (i) Deforestation has decreased the amount of forest cover on the island.

Describe the change in the pattern of forest cover on the island.

_____

_____

_____

_____

(2)

(ii) Give **two** possible reasons why the amount of forest has decreased between 1973 and 2010.

1. _____

_____

2. _____

_____

(2)

(b) Scientists are concerned about the effects of a decrease in forest cover on ecosystems.

Give **two** possible negative effects of the decrease in forest cover on ecosystems.

1. _____

_____

2. _____

_____

(2)

(Total 6 marks)

Q6.

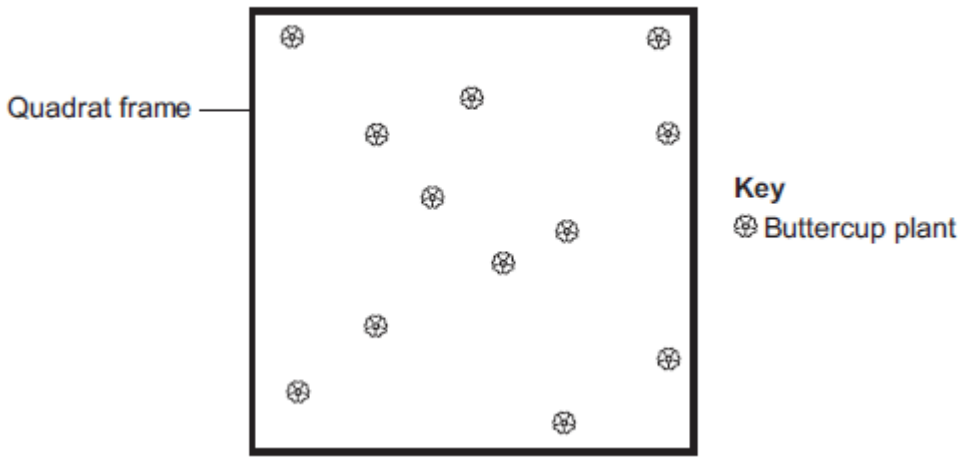
A grassy field on a farm measured 120 metres by 80 metres.

A student wanted to estimate the number of buttercup plants growing in the field.

The student found an area where buttercup plants were growing and placed a 1 m × 1 m quadrat in one position in that area.

Figure 1 shows the buttercup plants in the quadrat.

Figure 1



The student said, 'This result shows that there are 115 200 buttercup plants in the field.'

(a) (i) How did the student calculate that there were 115 200 buttercup plants in the field?

_____

_____

_____

_____

(2)

(ii) The student's estimate of the number of buttercup plants in the field is probably not accurate. This is because the buttercup plants are not distributed evenly.

How would you improve the student's method to give a more accurate estimate?

_____

_____

_____

_____

(2)

(b) Sunlight is one environmental factor that might affect the distribution of the buttercup plants.

(i) Give **three other** environmental factors that might affect the distribution of the buttercup plants.

1. _____

2. _____

3. _____

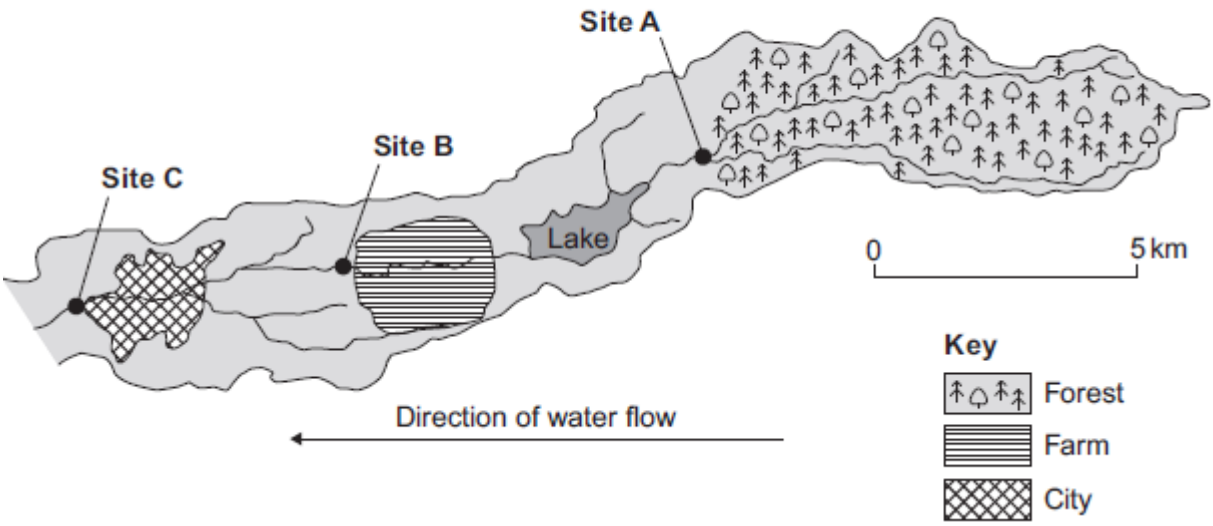
(3)

(ii) Explain how the amount of sunlight could affect the distribution of the buttercup plants.

(3)

(c) **Figure 2** is a map showing the position of the farm and a river which flows through it.

Figure 2



Every year, the farmer puts fertiliser containing mineral ions on some of his fields.When there is a lot of rain, some of the fertiliser is washed into the river.

(i) When fertiliser goes into the river, the concentration of oxygen dissolved in the water decreases.

Explain why the concentration of oxygen decreases.

(5)

(ii) There is a city 4 km downstream from the farm.

Apart from fertiliser, give **one** other form of pollution that might go into the river as it flows through the city.

(1)

(d) Three sites, **A**, **B** and **C**, are shown in **Figure 2**.

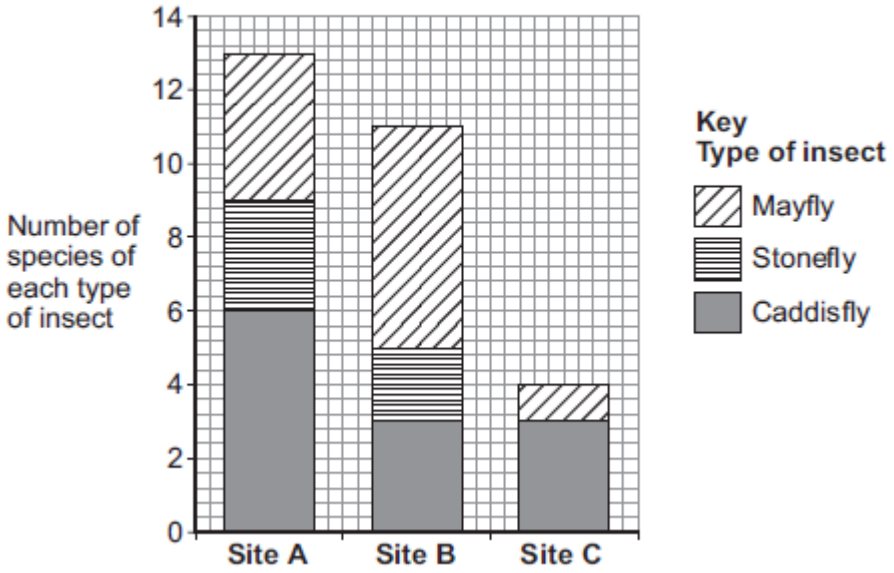
Scientists took many samples of river water from these sites.

The scientists found larvae of three types of insect in the water: mayfly, stonefly and caddisfly. For each type of insect the scientists found several different species.

The scientists counted the number of different species of the larvae of each of the three types of insect.

Figure 3 shows the scientists' results.

Figure 3



(i) How many more species of mayfly were there at Site **B** than at Site **A**?

_____

(1)

(ii) Suggest what caused this increase in the number of species of mayfly.

_____

_____

(1)

(iii) The scientists stated that the number of species of stonefly was the best indicator of the amount of oxygen dissolved in the water.

Use information from **Figure 3** to suggest why.

(1)

(Total 19 marks)

Q7.

(a) Which term describes organisms that can tolerate very hot or very cold places?

Draw a ring around the correct answer.

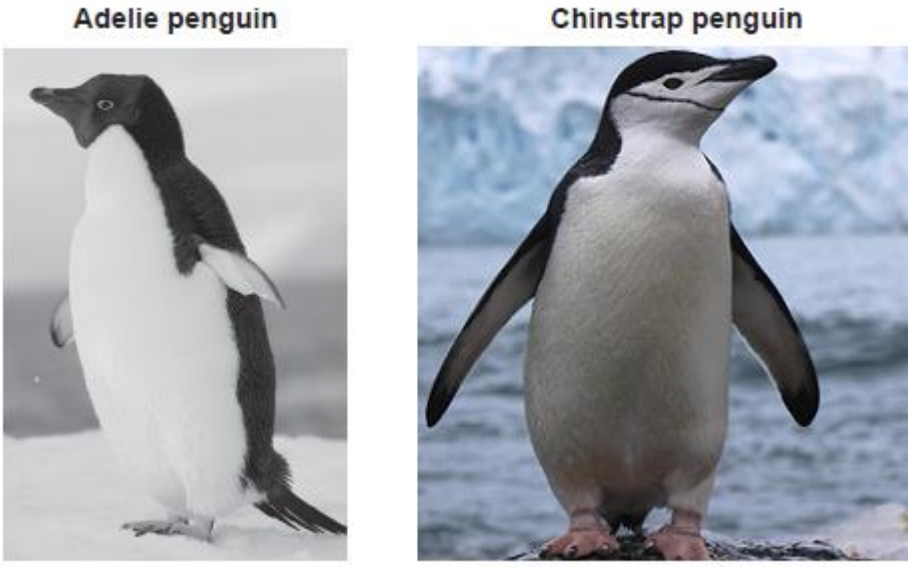
an environmental species **an extremophile species** **an indicator species**

(1)

(b) **Figure 1** shows photographs of an Adelie penguin and a chinstrap penguin. Adelie

penguins and chinstrap penguins live in the Antarctic at temperatures below 0 °C.

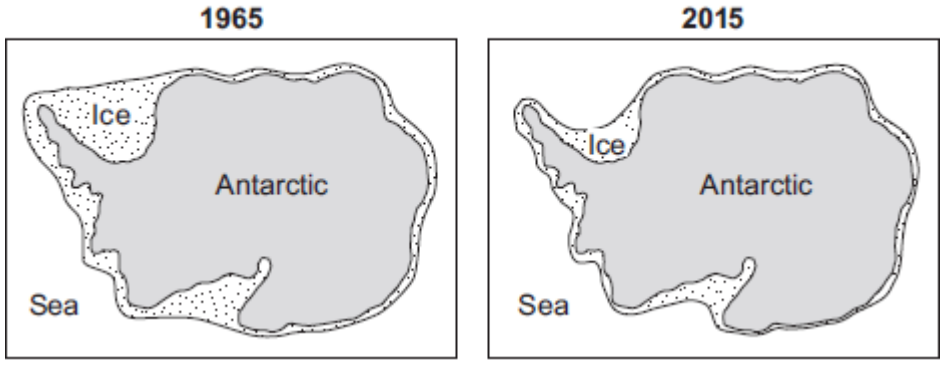
Figure 1



Adelie penguins spend most of their time on the ice around the Antarctic.
Chinstrap penguins live mainly in the sea around the ice.
Since 1965 the number of Adelie penguins has **decreased** by 6 million.

Figure 2 shows changes to the ice around the Antarctic over the past 50 years.

Figure 2



(i) Use information from **Figure 2** to explain why the number of Adelie penguins has decreased since 1965.

_____

_____

_____

_____

_____

_____

(2)

(ii) Suggest what has happened to the number of chinstrap penguins since 1965.

Draw a ring around your answer. **increase / decrease**

Give a reason for your answer.

_____

_____

(1)

(c) The number of penguins can be used to monitor changes in temperature of the environment.

Temperature readings could also be taken using a thermometer.

What is the advantage of using penguins, instead of a thermometer, to monitor changes in temperature of the environment?

Tick (✓) **one** box.

Living organisms show long-term changes. ☐

Thermometers cannot measure temperatures below 0 °C. ☐

Thermometers do not give accurate readings. ☐

(1)

(Total 5 marks)

Q8.

Gardeners sometimes use weed killers to control the growth of plants.

(a) A gardener wanted to get rid of daisy plants growing in a lawn.

The gardener investigated the use of a weed killer.

The gardener:

- recorded the number of daisy plants growing in different 10 m^2 areas of the lawn
- made solutions of the weed killer (each solution had a different concentration)
- put 5 dm^3 of each solution on different 10 m^2 areas of the lawn
- recorded the number of daisy plants growing in each area after 2 weeks.

The table shows the results.

Concentration of weed killer in arbitrary units	**Number of daisy plants per 10 m^2**	
	Before using weed killer	**2 weeks after using weed**

		killer
0 (water)	8	8
20	6	8
40	9	6
60	5	2
80	4	0
100	8	0

(i) To make the investigation fair, the gardener controlled some variables.

Give **one** variable the gardener controlled in the investigation.

_____

_____

(1)

(ii) The gardener decided that the result for a concentration of 20 arbitrary units of weed killer was anomalous.

Suggest why the gardener decided this result was anomalous.

_____

_____

(1)

(iii) Why did the gardener put 0 arbitrary units of weed killer on one area of the lawn?

_____

_____

(1)

(iv) The gardener concluded that the best concentration of weed killer to use all over a lawn is 100 arbitrary units.

Suggest why the gardener cannot be sure about this conclusion.

_____

_____

(1)

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

Plants respond to different environmental factors.

Describe how different environmental factors affect:

- the direction of growth of roots

- the direction of growth of shoots.

In your answer you should refer to the role of plant hormones.

Do **not** refer to the artificial use of plant hormones by gardeners or scientists.

(6)
(Total 10 marks)

Q9.

Organisms compete with each other.

(a) **Figure 1** shows two types of seaweed which live in similar seashore habitats.

Figure 1

Most of the time the two seaweeds are covered with water.

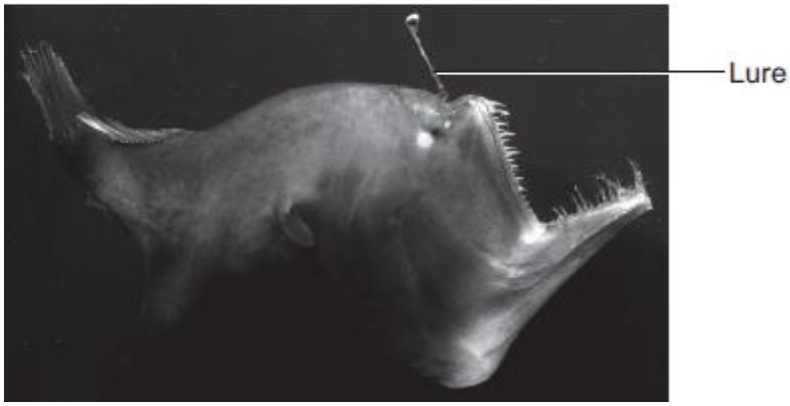
Bladder wrack has bladders filled with air.

Bladder wrack grows more quickly than saw wrack.
Suggest an explanation why.

(3)

(b) **Figure 2** shows an angler fish.

Figure 2



Angler fish live at depths of over 1000 m.

In clear water, sunlight does not usually reach more than 100 m deep.
Many angler fish have a transparent 'lure' containing a high concentration of bioluminescent bacteria.
Bioluminescent bacteria produce light.

Suggest an advantage to the angler fish of having a lure containing bioluminescent bacteria.

(2)

(Total 5 marks)

Q10.

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.

_____

_____

_____

_____

_____

_____

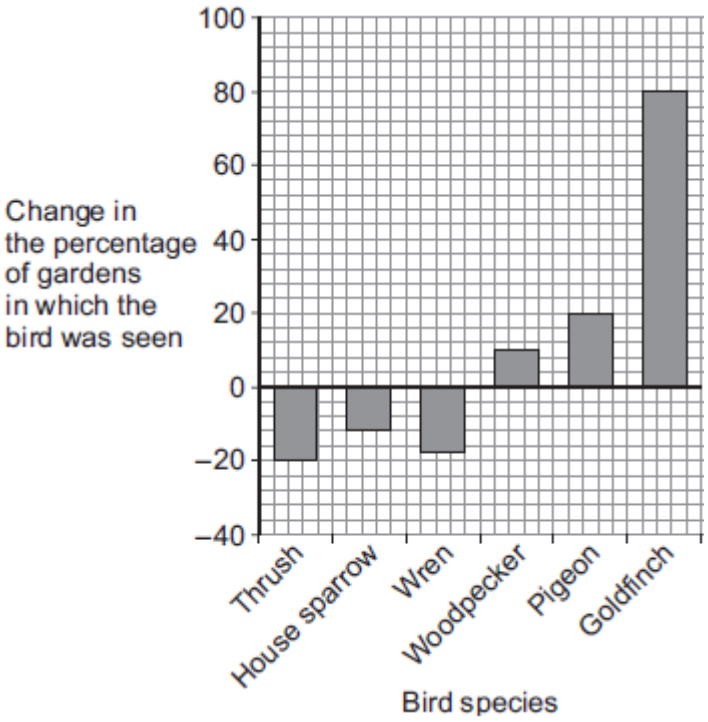
_____

_____

(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)

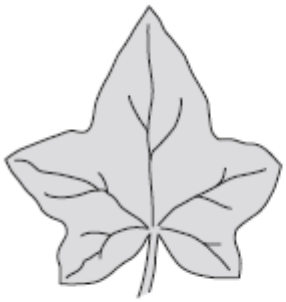
Q11.

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

Ivy plants can grow up trees and walls.

Figure 1 shows two ivy leaves. One leaf is from an ivy plant growing up a tree in the centre of a shady woodland area. The other leaf is from an ivy plant growing up a tree in a sunny area at the edge of the woodland.

Figure 1



Ivy leaf from shady woodland area
(centre of woodland)

Ivy leaf from sunny area
(edge of woodland)

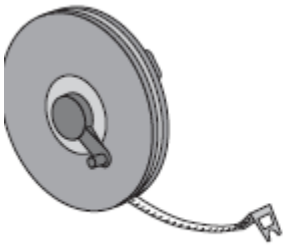
A student makes the following hypothesis.

"The size of ivy leaves decreases as light intensity increases."

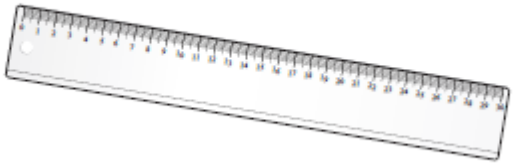
How would you use the apparatus shown in **Figure 2** to test this hypothesis?

You should include details of how you would make sure the results are valid.

Figure 2



100 m tape measure



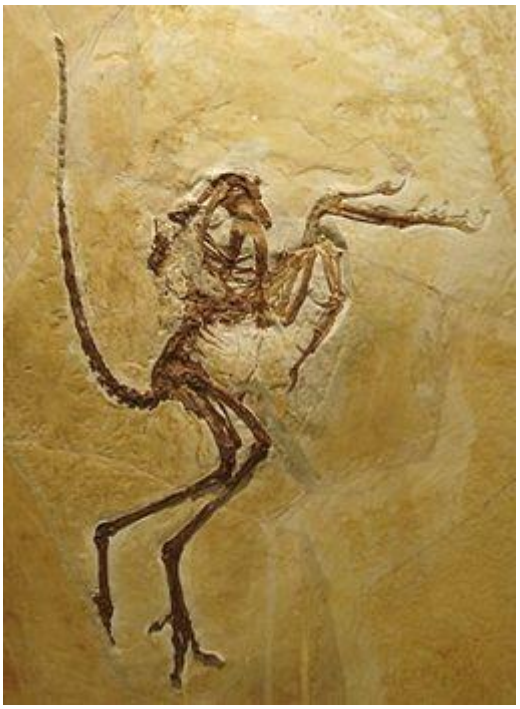
Ruler

Light meter

(Total 6 marks)

Q12.

The photograph shows a fossil of a prehistoric bird called *Archaeopteryx*.



By Ghedoghedo (own work) [CC-BY-SA-3.0 (http://creativecommons.org/licenses/BY-SA-3.0) or GFDL (http://www.gnu.org/copyleft/fdl.html)], via Wikimedia Commons; By Steenbergs from Ripon, United Kingdom (Small Fishing Boat In North Sea) [CC-BY-2.0 (http://creativecommons.org/licenses/by/2.0)], via Wikimedia Commons.

(a) Describe **three** ways fossils can be made.

_____

_____

_____

_____

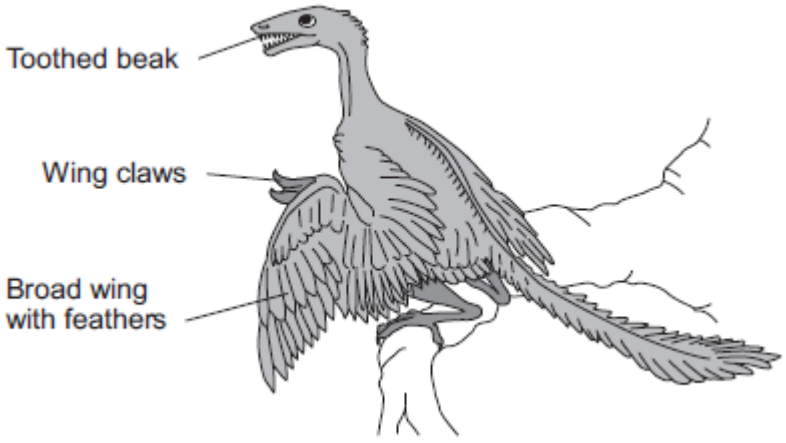
_____

_____

(3)

(b) The drawing shows what an *Archaeopteryx* might have looked like when it was alive.

Scientists think that *Archaeopteryx* was a predator.



(i) Look at the drawing.

Write down **three** adaptations that might have helped *Archaeopteryx* to catch prey.

How would **each** adaptation have helped *Archaeopteryx* to catch prey?

Adaptation 1 _____

How it helps _____

_____

Adaptation 2 _____

How it helps _____

_____

Adaptation 3 _____

How it helps _____

_____

(3)

(ii) *Archaeopteryx* is now extinct.

Give **two** reasons why animals may become extinct.

1. _____

_____

2. _____

_____

(2)

(Total 8 marks)

Q13.

Freshwater streams may have different levels of pollution. The level of pollution affects which species of invertebrate will live in the water.

Table 1 shows the biomass of different invertebrate species found in two different streams, **X** and **Y**.

Table 1

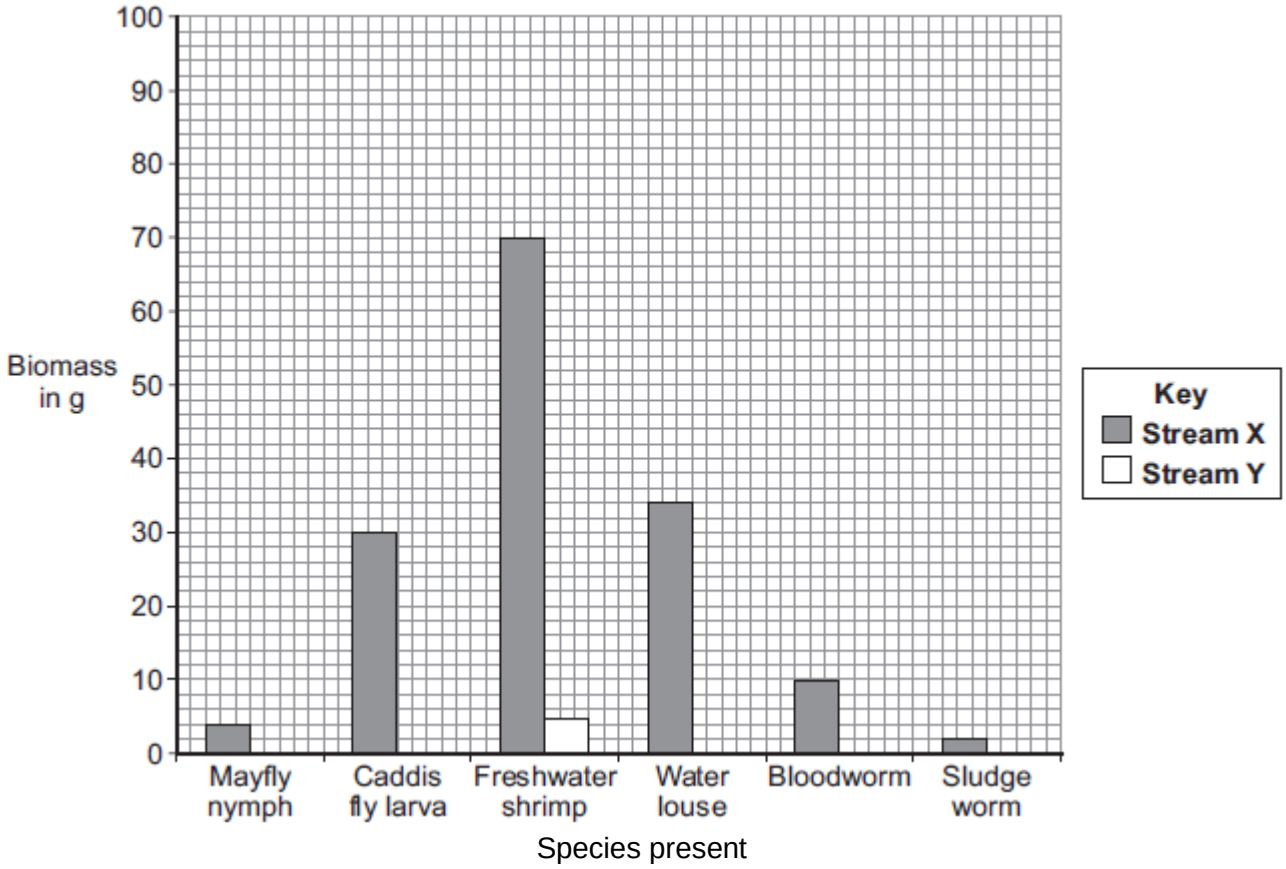
	Biomass in g	
Invertebrate species	**Stream X**	**Stream Y**
Mayfly nymph	4	0
Caddis fly larva	30	0
Freshwater shrimp	70	5

Water louse	34	10
Bloodworm	10	45
Sludge worm	2	90
Total	**150**	**150**

(a) The bar chart below shows the biomass of invertebrate species found in **Stream X**.

(i) Complete the bar chart by drawing the bars for water louse, bloodworm and sludge worm in **Stream Y**.

Use the data in **Table 1**.



(2)

(ii) **Table 2** shows which invertebrates can live in different levels of water pollution.

Table 2

Pollution level	**Invertebrate species likely to be present**
Clean water	Mayfly nymph
Low pollution	Caddis fly larva, Freshwater shrimp
Medium pollution	Water louse, Bloodworm
High pollution	Sludge worm

Which stream, **X** or **Y**, is more polluted?
Use the information from **Table 1** and **Table 2** to justify your answer.

_____

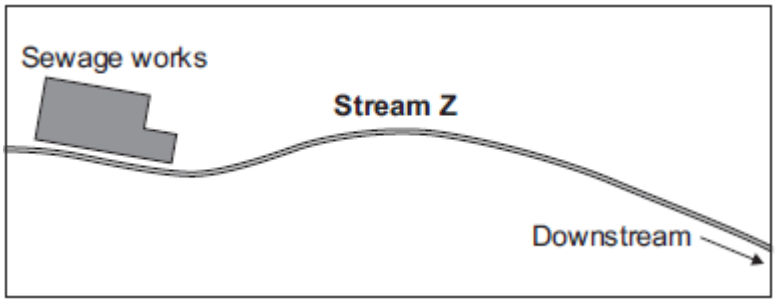
_____

_____

_____

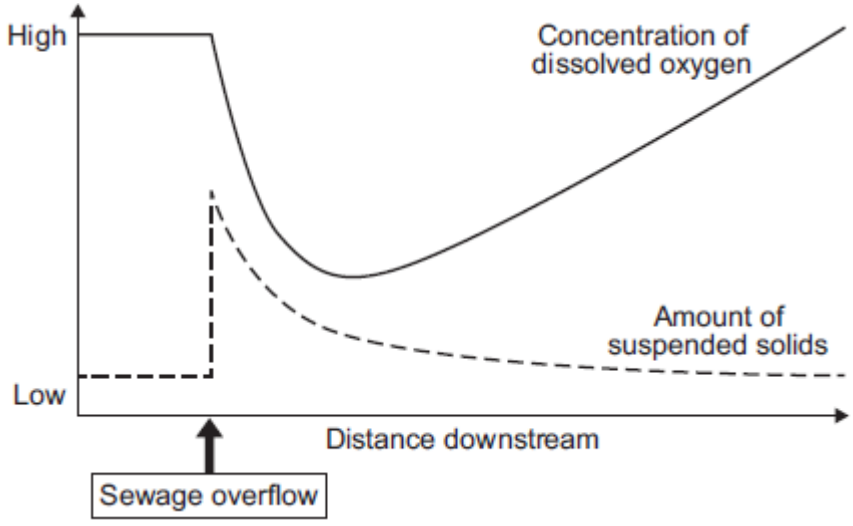
(2)

(b) There is a sewage works near another stream, **Z**.

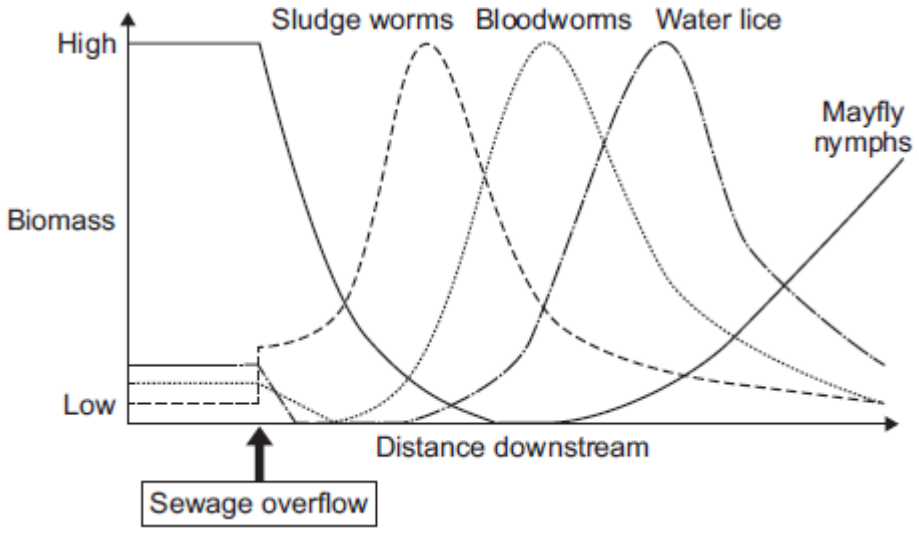


An accident caused sewage to overflow into **Stream Z**.
Two weeks later scientists took samples of water and invertebrates from the stream.
They took samples at different distances downstream from where the sewage overflowed.
The scientists plotted the results shown in **Graphs P** and **Q**.

Graph P: change in water quality downstream of sewage overflow



Graph Q: change in invertebrates found downstream of sewage overflow



(i) Describe the patterns shown in **Graph P**.

(4)

(ii) Describe the relationship between dissolved oxygen and the survival of mayfly nymphs in **Stream Z**. Suggest a reason for the pattern you have described.

(3)

(c) Many microorganisms are present in the sewage overflow.

Explain why microorganisms cause the level of oxygen in the water to decrease.

_____

_____

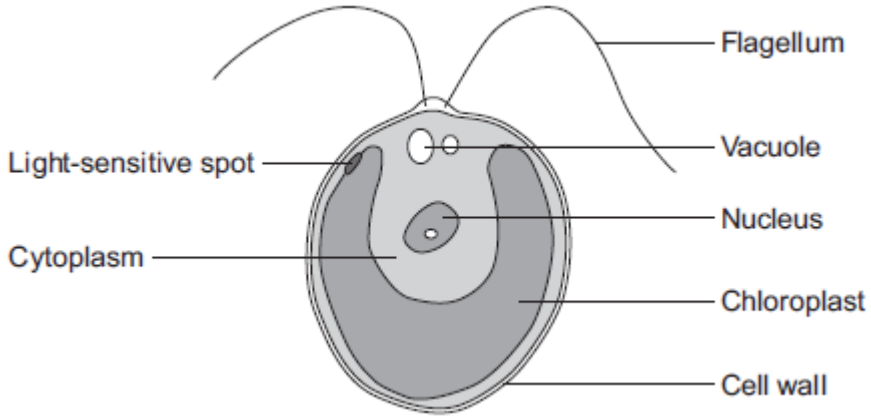
_____

(2)

(Total 13 marks)

Q14.

The diagram below shows a single-celled alga which lives in fresh water.



(a) Which part of the cell labelled above:

(i) traps light for photosynthesis

_____

(1)

(ii) is made of cellulose?

_____

(1)

(b) In the freshwater environment water enters the algal cell.

(i) What is the name of the process by which water moves into cells?

_____

(1)

(ii) Give the reason why the algal cell does not burst.

_____

_____

(1)

(c) (i) The alga can photosynthesise.

Complete the **word** equation for photosynthesis.

water + _____ $\xrightarrow{\text{Light energy}}$ _____ + oxygen

(2)

(ii) The flagellum helps the cell to move through water. Scientists think that the flagellum and the light-sensitive spot work together to increase photosynthesis.

Suggest how this might happen.

_____

_____

_____

_____

(2)

(d) Multicellular organisms often have complex structures, such as lungs, for gas exchange.

Explain why single-celled organisms, like algae, do **not** need complex structures for gas exchange.

_____

_____

_____

_____

_____

_____

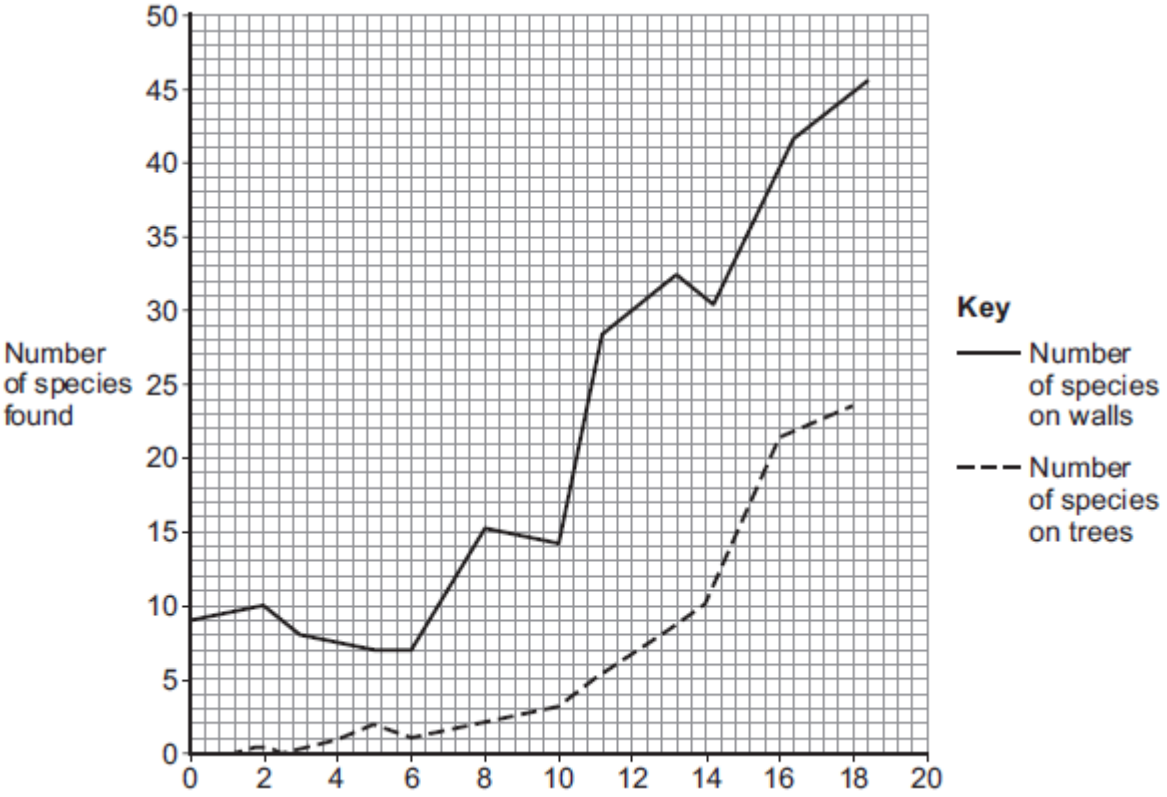
(3)

(Total 11 marks)

Q15.

Lichens can be used as air pollution indicators.

The graph below shows the number of lichen species found growing on walls and trees at increasing distances from a city centre.



(a) (i) How many species of lichen are found on walls 2 km from the city centre?

_____

(1)

(ii) Describe the patterns in the data.

_____

_____

_____

_____

_____

_____

(3)

(b) The table below shows the concentration of sulfur dioxide (SO_2) in the air at different distances from the same city centre.

Distance from city centre in km	**SO_2 concentration in g per m^3**
0	200
3	160
8	110

13	85
18	65

Suggest how the data in the table could explain the patterns in the graph above.

_____

_____

_____

_____

(2)

(c) Nitrogen oxides are also air pollutants.

The main source of nitrogen oxide pollution comes from road vehicles.

Different lichen species vary in their tolerance of the levels of nitrogen oxides in the air.

Some lichens can only grow in very clean air where there are low levels of nitrogen oxides. They are nitrogen-sensitive.

Some lichens grow very well in high levels of nitrogen oxides. They are nitrogen-loving.

The table below shows one lichen species which is nitrogen-sensitive and one lichen species which is nitrogen-loving.

Nitrogen-sensitive	**Nitrogen-loving**
Usnea 	*Xanthoria* 

Usnea © epantha/iStock/Thinkstock;
Xanthoria By Zakwitnij!pl Ejdzej + Iric (CC BY-SA.2.0) via wikicommons

(i) Describe how you would investigate the distribution of the two lichens at different distances into a wood from a main road.

_____

_____

_____

_____

_____

_____

_____

(3)

(ii) Predict the results from the experiment you described in your answer to part **(c)(i)**. Explain why you made this prediction.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 12 marks)

Q16.

A project called Garden Bird Watch counts the UK populations of common birds. 16 000 people count the number of birds in their gardens every week of the year.

The results are analysed by researchers and written up in important scientific magazines.

(a) Suggest **one** advantage of this method of collecting data.

_____

_____

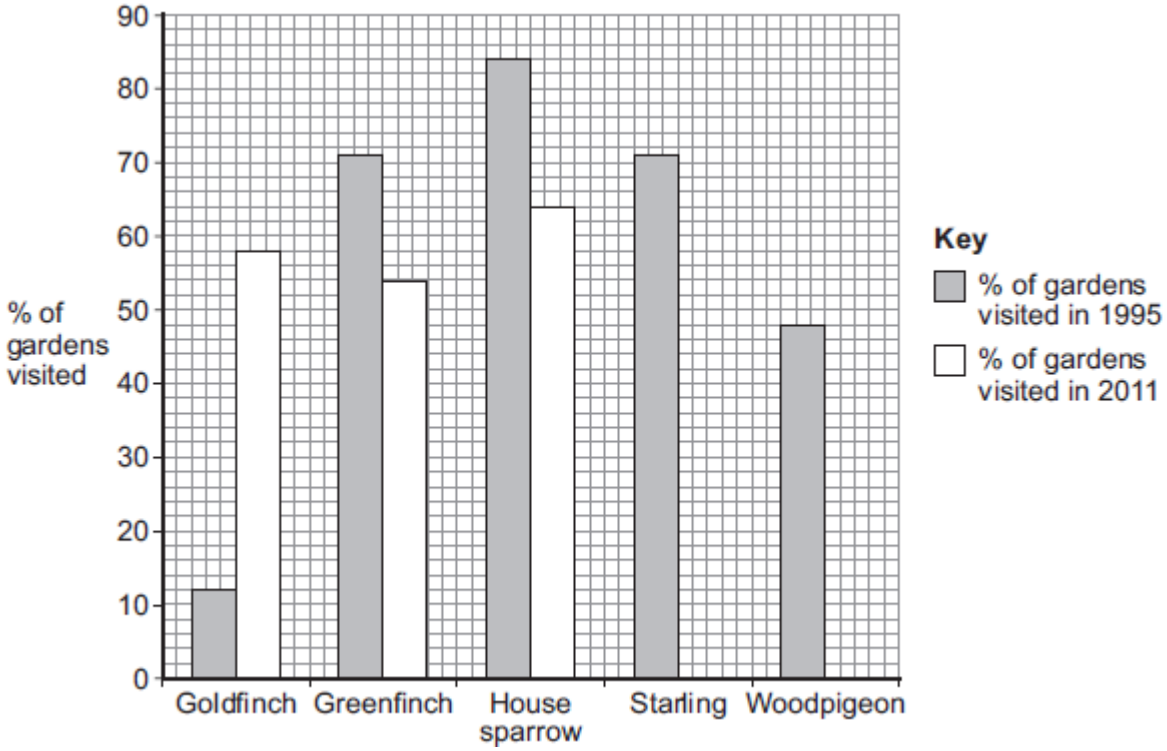
The table below shows the percentage (%) of gardens visited by different bird species in 1995 and in 2011.

Bird species	**% of gardens visited in 1995**	**% of gardens visited in 2011**
Goldfinch	12	58
Greenfinch	71	54
House sparrow	84	64
Starling	71	42
Woodpigeon	48	80

(1)

(b) (i) Complete the bar chart below, by plotting the data from the table above for 2011.

Some have been done for you.



(2)

(ii) In this survey, the results from 16 000 gardens were sent in.

How many gardens were visited by woodpigeons in 2011?

_____

(2)

(iii) Which bird species has increased the most from 1995 to 2011?

_____

(1)

(c) The change in the number of woodpigeons may be partly because they have spread to towns and cities.
Suggest why this increase in woodpigeons in towns and cities might have occurred.

_____

_____

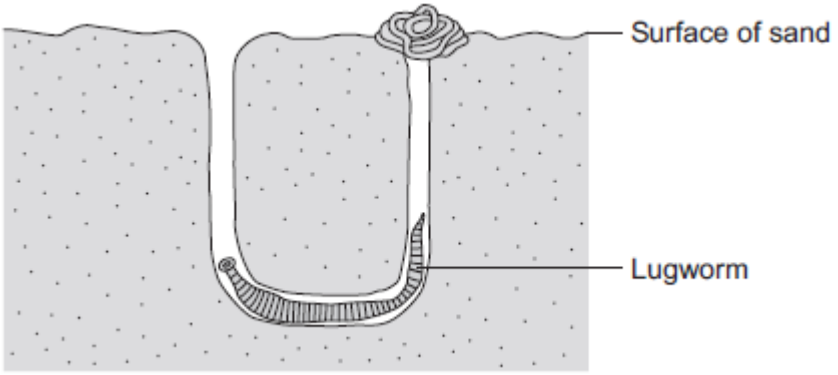
(1)

(Total 7 marks)

Q17.

The lugworm lives in a U-shaped burrow in the sand on the seashore.

The diagram below shows a lugworm in its burrow.



(a) Some scientists investigated the effect of different salt concentrations on lugworms.

The scientists:

- collected 50 lugworms from the seashore
- separated them into five groups of 10 lugworms
- weighed each group of 10 lugworms
- placed each group into a different concentration of salt solution and left them for 8 hours
- took each lugworm out of the solution and placed it on blotting paper for 30 seconds
- re-weighed each group of 10 lugworms.

(i) Why did the scientists use groups of 10 lugworms and not just 1 lugworm at each concentration?

_____

_____

(1)

(ii) Suggest why the scientists placed each lugworm on blotting paper for 30 seconds before they reweighed the groups of lugworms.

_____

_____

(1)

(iii) How might the method of blotting have caused errors in the results?

_____

_____

(1)

(iv) Suggest **one** improvement the scientists could make to their investigation.

_____

(1)

(b) The table below shows the scientists' results.

Concentration of salt in arbitrary units	Mass of 10 lugworms at start in grams	Mass of 10 lugworms after 8 hours in grams	Change in mass in grams	Percentage (%) change in mass
1.0	41.2	61.8	+20.6	+50
2.0	37.5	45.0	+7.5	
3.0	55.0	56.1	+1.1	+2
4.0	46.2	22.2	-24.0	-52
5.0	45.3	22.6	-22.7	-50

(i) The scientists calculated the **percentage** change in mass at each salt concentration.

Why is the **percentage** change in mass more useful than just the change in mass in grams?

Use information from the table in your answer.

_____

_____

_____

_____

(2)

(ii) Calculate the percentage change in mass for the 10 lugworms in the salt solution with a concentration of 2.0 arbitrary units.

_____

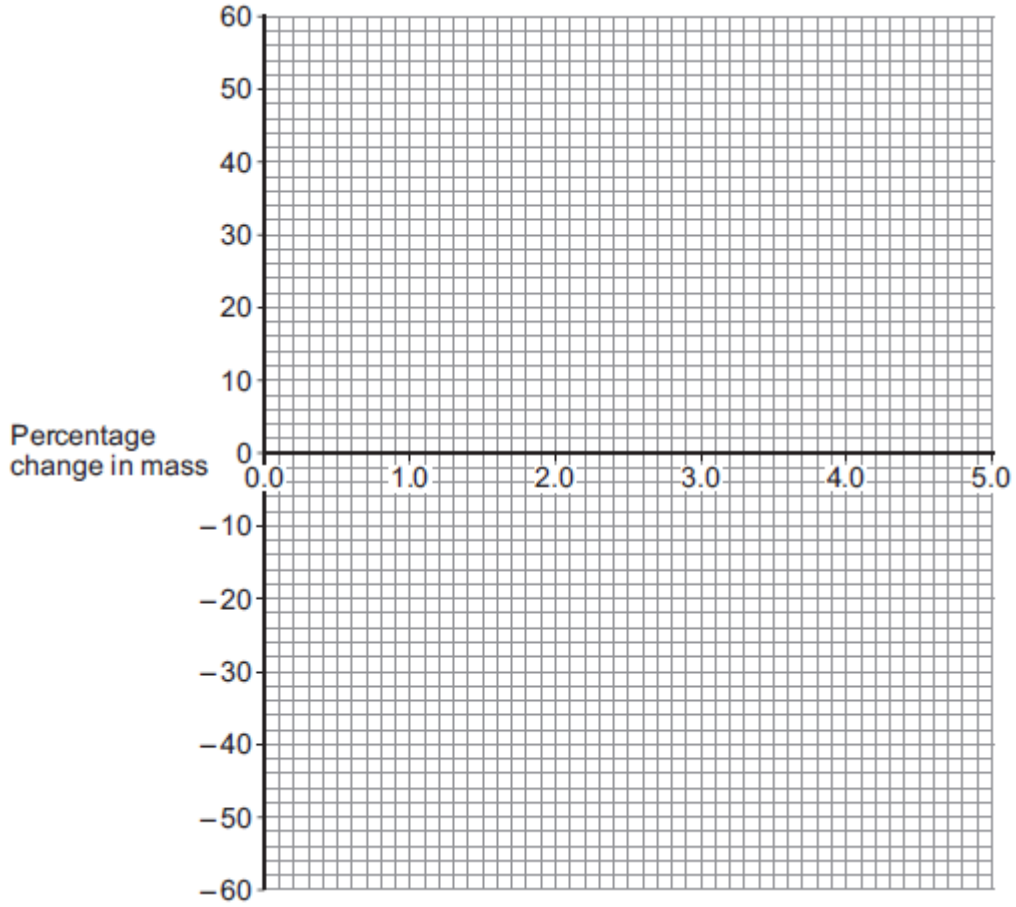
_____

Percentage change in mass = _____ %

(2)

(c) (i) On the graph paper below, draw a graph to show the scientists' results:

- plot the **percentage** change in mass
- label the horizontal axis
- draw a line of best fit.



(4)

(ii) The scientists thought one of their results was anomalous.

Draw a ring around the anomalous result on your graph.

(1)

(iii) Suggest what might have happened to cause this anomalous result.

_____

_____

(1)

(d) (i) What do you think is the concentration of salts in the lugworm's natural environment?

Use information from your graph to give the reason for your answer.

Concentration = _____ %

Reason _____

_____

_____

_____

(2)

(ii) The mass of the lugworms decreased in the salt solution with a concentration of 5.0 arbitrary units.

Explain what caused this.

_____

_____

_____

_____

_____

_____

(3)

(Total 19 marks)

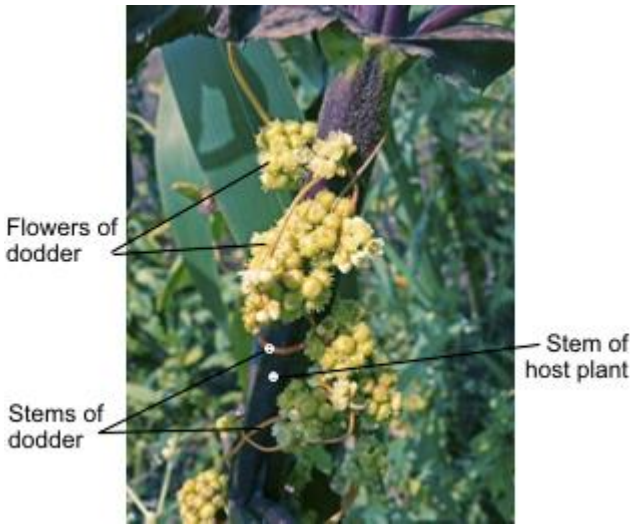
Q18.

(a) Dodder is an unusual flowering plant. It is a parasite.

The dodder plant:

- has no chlorophyll
- has no roots
- has no leaves
- grows attached to the stem of a host plant.

The image below shows dodder attached to its host plant.



(i) Dodder has no chlorophyll. Most plants have leaves containing chlorophyll.

What is the function of chlorophyll in most plants?

_____

_____

_____

(2)

(ii) Parts of the dodder stem grow into the host stem and attach to the host's phloem tissue.

Suggest why it is helpful to the dodder plant to be attached to the host's phloem tissue.

(1)

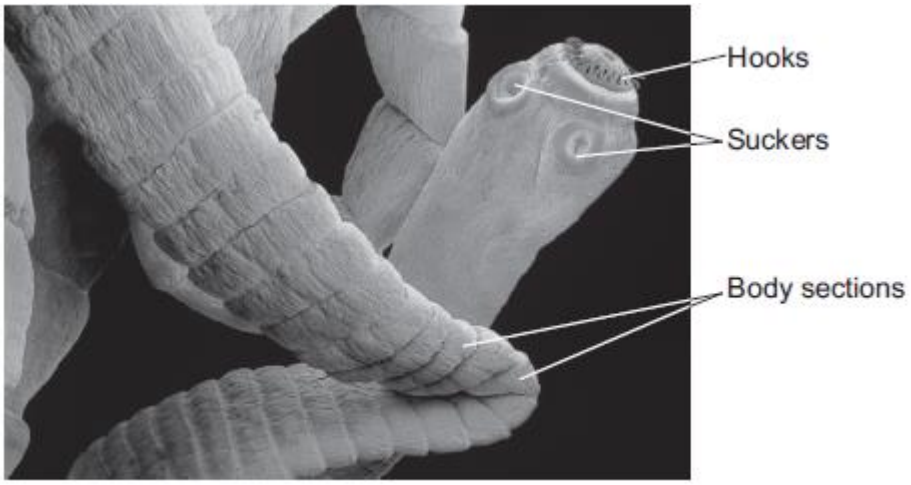
(iii) Suggest why the dodder will have a harmful effect on the host plant.

(1)

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

The tapeworm is another parasite.

The image below shows part of a tapeworm.



The tapeworm lives inside the small intestine of a mammal.

Describe and explain how the tapeworm is adapted for living inside the small intestine of its host.

Extra space

(6)

(Total 10 marks)

Q19.

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

Animals and plants have features (adaptations) that allow them to survive in the conditions in which they normally live.

Describe how animals and plants are adapted to survive in dry conditions such as deserts.

For each adaptation that you give, describe how the adaptation helps the animal or plant to survive in dry conditions.

To obtain full marks you should refer to **both** animals and plants.

Extra space _____

(Total 6 marks)

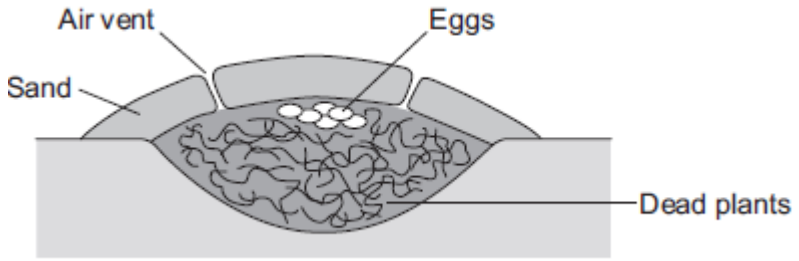
Q20.

Most birds sit on their eggs to keep them warm until they hatch.

Megapode birds:

- dig a large hole in sand
- fill the hole with dead plants
- lay their eggs on top of the dead plants
- cover the surface with a thick layer of sand.

The image below shows a megapode bird's nest.



(a) The dead plants in the nest decay. The decaying process helps to keep the eggs warm for many weeks.

Suggest how.

_____

_____

(3)

(b) (i) Megapode birds open and close the air vents of the nest at different times of the day.

Suggest reasons why it is necessary to open and close the air vents.

_____

_____

_____

_____

_____

_____

(3)

(ii) The sex of a megapode bird that hatches from an egg depends on the temperature at which the egg was kept.

Use this information to suggest why it is important for megapode birds to control the temperature of their nests.

_____

_____

(1)

(Total 7 marks)

Q21.

Some students investigated the distribution of dandelion plants in a grassy field. The grassy field was between two areas of woodland.

Figure 1 shows two students recording how many dandelion plants there are in a 1 metre x 1 metre quadrat.

Figure 1

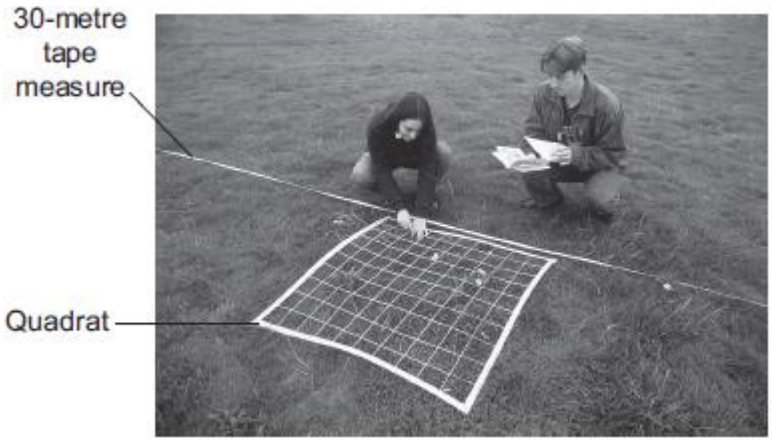
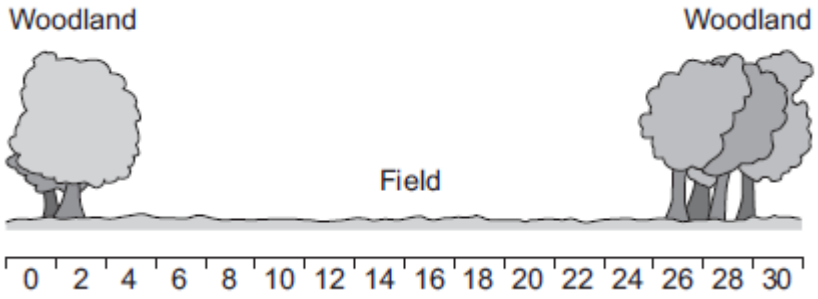


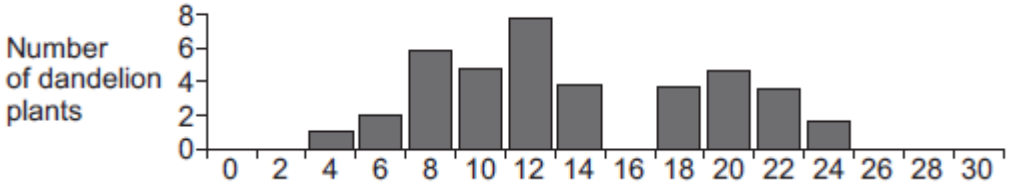
Figure 2 shows a section across the area studied and **Figure 3** shows a bar chart of the students' results.

Figure 2



Distance in m

Figure 3



Distance in m

(a) How did the students use the quadrat and the 30-metre tape measure to get the results in **Figure 3**?

Use information from **Figure 1**.

_____

_____

_____

_____

_____

_____

(3)

(b) (i) Suggest **one** reason why the students found no dandelion plants under the trees.

_____

_____

(1)

(ii) Suggest **one** reason why the students found no dandelion plants at 16 metres.

_____

_____

(1)

(c) The teacher suggested that it was **not** possible to make a valid conclusion from these results.

Describe how the students could improve the investigation so that they could make a valid conclusion.

_____

_____

_____

_____

(2)

(Total 7 marks)

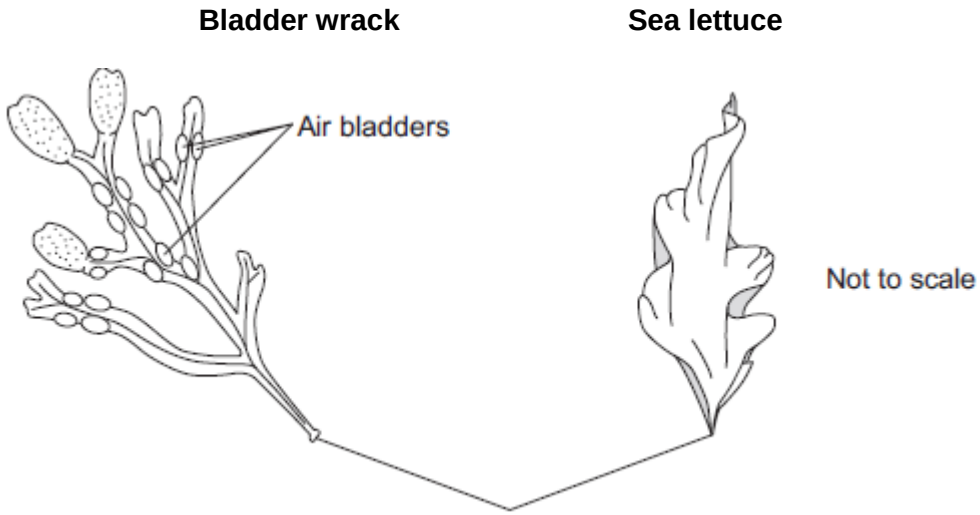
Q22.

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

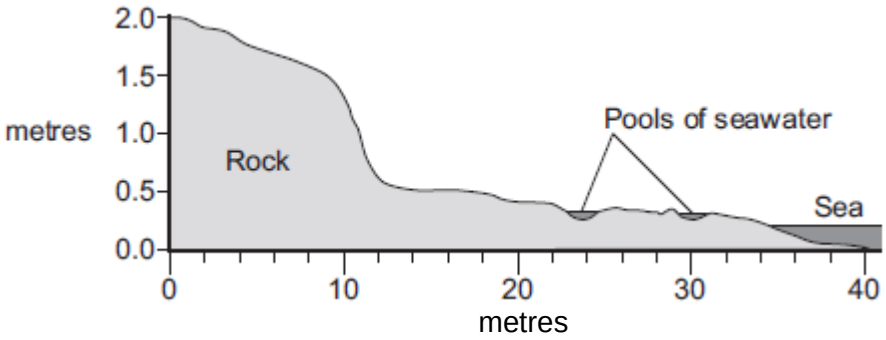
3 recorded whether each species was present or not.

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

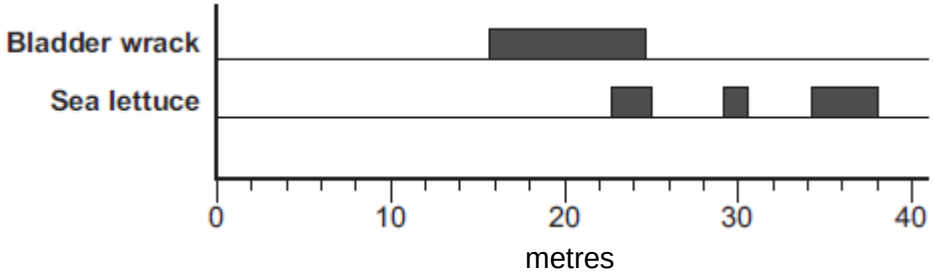
Figure 2 shows a section of the seashore and the students' results.

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?

_____

_____

_____

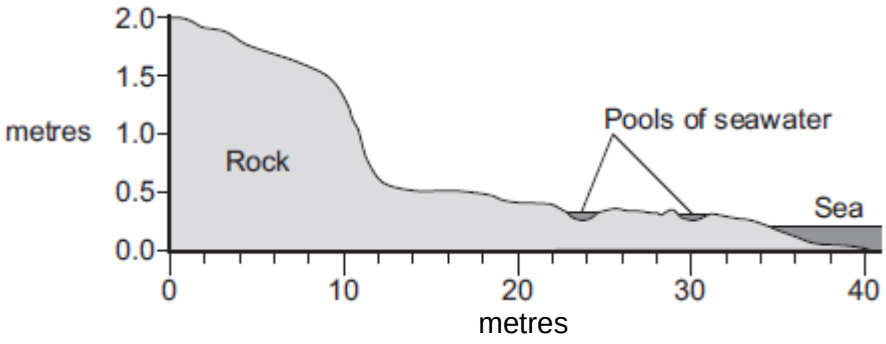
_____

(2)

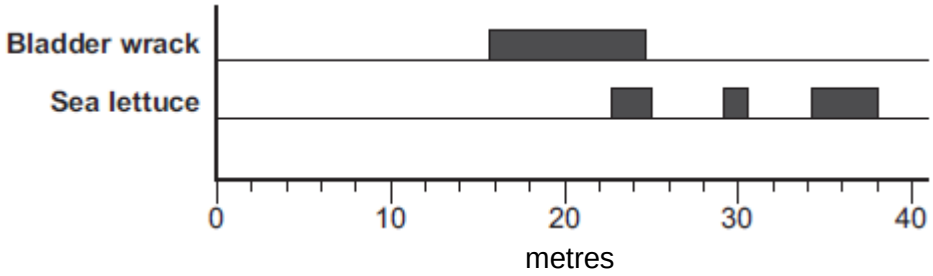
(iii) **Figure 2** is repeated here to help you answer this question.

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.

_____

_____

_____

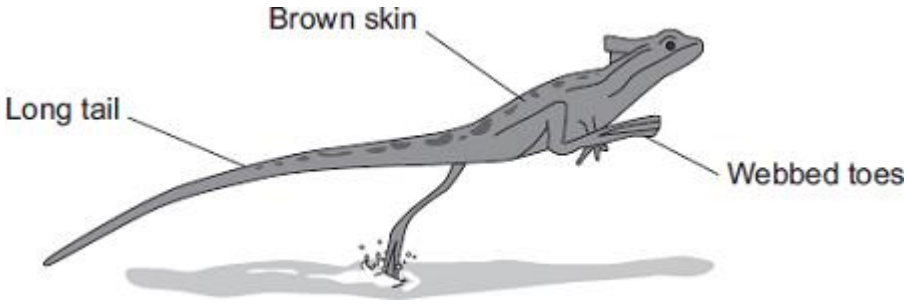
_____

(2)

(Total 8 marks)

Q23.

The picture shows a basilisk lizard. Some of the adaptations of the lizard are labelled.



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.

Adaptation	**Advantage**
	For camouflage on branches of trees
Toes on the back feet are webbed	
	Helps the lizard to balance when running
Long tail	
	Warning colours to deter predators
Brown skin	
	Increases surface area in contact with the water

(3)

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

_____

_____

(1)

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

Give **two** factors that animals compete for.

Tick (✓) **two** boxes.

Oxygen ☐

Food ☐

Territory ☐

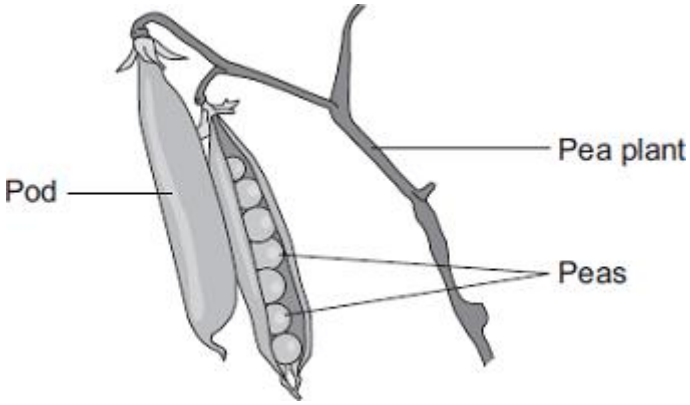
Light ☐

(2)

(Total 6 marks)

Q24.

Peas grow in pods on pea plants.



A gardener grew four varieties of pea plants, **A** , **B** , **C** and **D** , in his garden.
The gardener counted the number of peas in each pod growing on each plant.

The table shows his results.

Variety	Range of number of peas in each pod	Mean number of peas in each pod
A	2–6	4
B	3–7	5
C	3–8	6
D	6–8	7

(a) Give **one** environmental factor and **one other** factor that might affect the number of peas in a pod.

Environmental factor _____

Other factor _____

(2)

(b) The gardener thinks that he will get the largest mass of peas from his garden if he grows variety **D**.

Why is the gardener **not** correct?

Suggest **one** reason.

_____

_____

(1)

(c) It is important that carbon is cycled through living things.

After he has picked the peas, the gardener puts the dead pea plants onto a compost heap.

Over the next few months, the carbon in the carbon compounds from the pea plants is returned to the air.

Describe how.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 7 marks)

Q25.

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.

Position on shore	Small periwinkle	Rough periwinkle	Common periwinkle	Flat periwinkle
High tide level ↓ Low tide level				

(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)

Q26.

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)

Q27.

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)

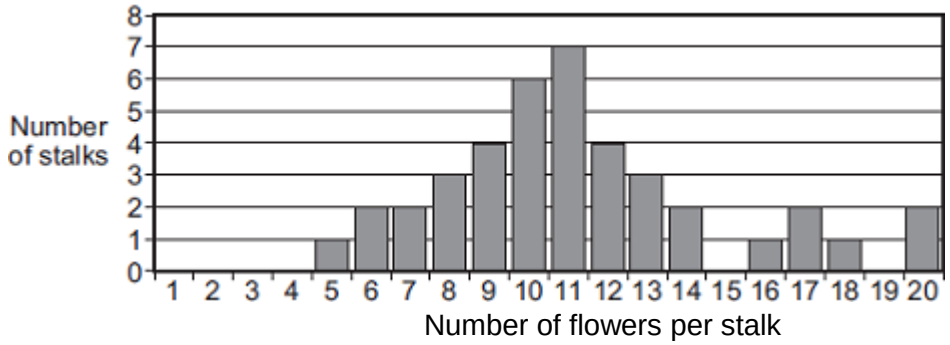
Q28.

Some students studied bluebell plants growing in two different habitats.

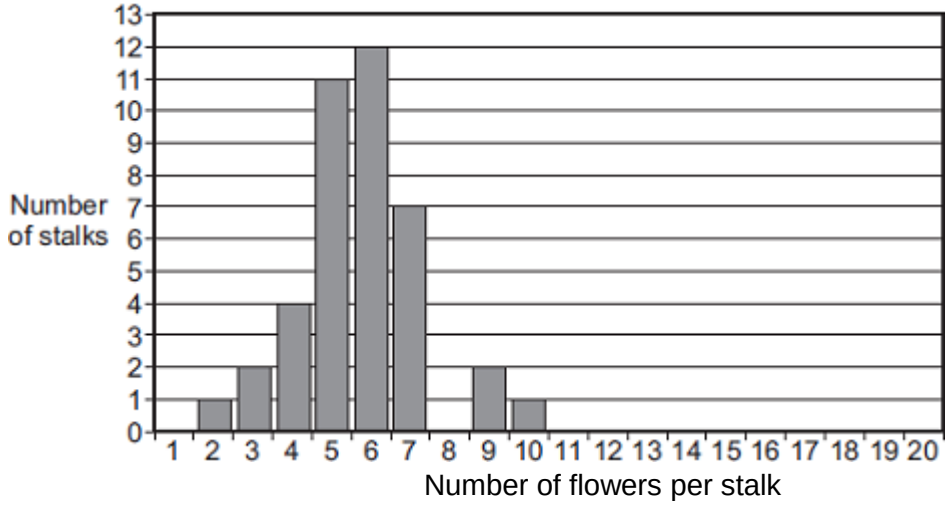
Habitat **A** was a sunny field next to woodland.
Habitat **B** was a shady, moist woodland.

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)

Q29.

Animals and plants are adapted in different ways in order to survive.

(a) Plants may have to compete with other plants.

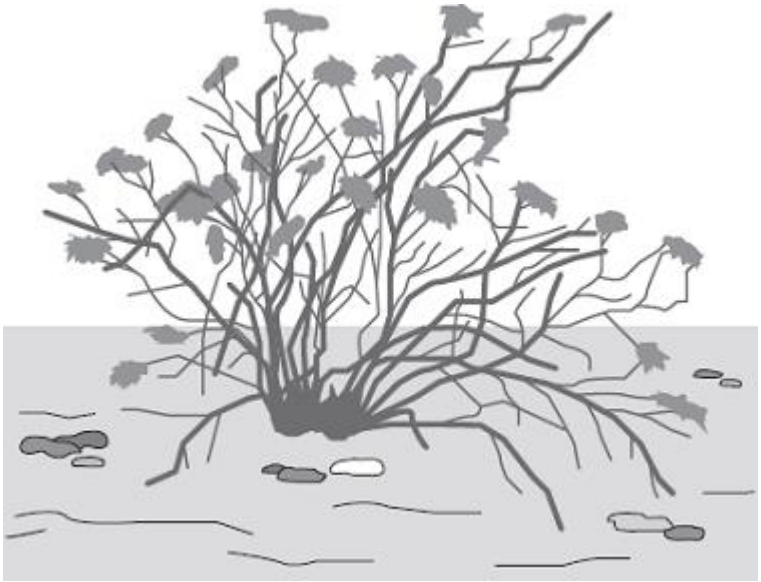
(i) Name **two** things for which plants compete.

1. _____

2. _____

(2)

(ii) The drawing shows a creosote bush.



This bush lives in a desert.

The creosote bush produces a poison that kills the roots of other plants.

How does this poison help the creosote bush to survive in the desert?

_____

_____

(1)

(b) The photograph shows an insect called a katydid.

By Ltshears (Own work) [Public domain], via Wikimedia Commons

The katydid is preyed on by birds.

How does the appearance of the katydid help it to survive?

_____

_____

_____

_____

(1)

(Total 4 marks)

Q30.

Organisms have adaptations that enable them to survive in extreme conditions.

(a) The photograph shows an arctic fox.

By Algkalv (Own work) [CC-BY-3.0], via Wikimedia Commons

This fox lives in the Arctic, where it is very cold.

Suggest **two** ways in which the arctic fox is adapted for life in very cold conditions.

Explain how each adaptation helps the arctic fox to survive in very cold conditions.

Adaptation 1 _____

_____

How this adaptation helps the arctic fox to survive in very cold conditions.

_____

_____

_____

Adaptation 2 _____

_____

How this adaptation helps the arctic fox to survive in very cold conditions.

_____

_____

_____

(4)

(b) The photograph shows an antelope that lives in a sandy desert.

By Sun417 at zh.wikipedia [Public domain],
from Wikimedia Commons

The antelope is prey to large cats such as cheetahs.

Suggest **one** adaptation that helps this antelope avoid being killed by predators.

Explain how this adaptation helps the antelope avoid being killed by predators.

Adaptation _____

_____

How this adaptation helps the antelope avoid being killed by predators.

_____

_____

_____

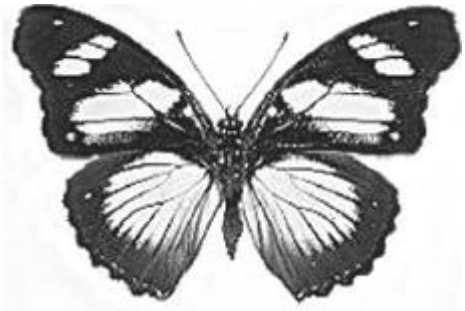
(2)

(Total 6 marks)

Q31.

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*.

_____

_____

_____

_____

_____

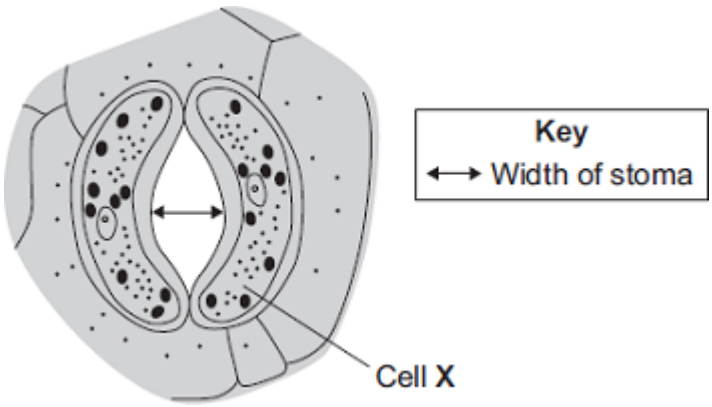
_____

(3)

(Total 5 marks)

Q32.

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	**Mean width of stomata as a percentage of**

	hours	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)

Q33.

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)

Q34.

Penguins live mainly in the Antarctic. Penguins eat mainly fish.
Photograph 1 shows a penguin swimming underwater.

Photograph 1

© raywoo/iStock

(a) Use information from **Photograph 1** to suggest **three** ways the penguin is adapted for catching fish.

1. _____

_____

2. _____

_____

3. _____

_____

(3)

(b) The Antarctic winter is very cold. In the winter some species of penguin huddle together as shown in **Photograph 2**.

Photograph 2

© Fuse

Suggest how the behaviour shown in **Photograph 2** helps the penguins to survive the Antarctic winter.

_____

_____

_____

_____

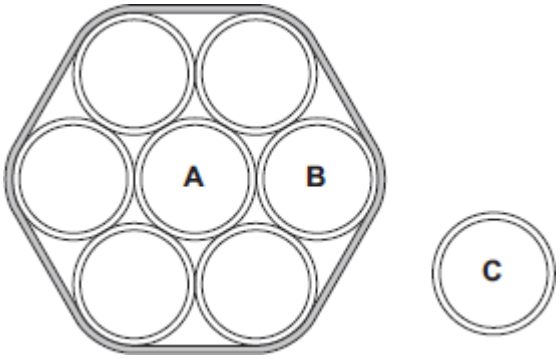
_____

_____

(3)

(c) A student did an investigation to model the behaviour of the penguins shown in **Photograph 2**.

The diagram shows the apparatus the student used.



The student:

- held seven similar test tubes together with elastic bands as shown in the diagram
- stood a similar eighth tube in a test tube rack
- filled each of the eight tubes with hot water to the same level
- measured the temperature of the water in tubes **A**, **B** and **C** every 2 minutes for 20 minutes.

The table shows the student's results.

Time in Minutes	Temperature in °C		
	Tube A	Tube B	Tube C
0	65	65	65
2	65	65	64
4	65	64	63
6	64	64	62
8	64	63	61
10	64	63	60
12	63	62	59
14	63	62	58
16	63	61	57
18	62	61	56
20	62	60	55

(i) Give **two** variables that were controlled in the investigation.

1. _____

2. _____

(2)

(ii) Describe the patterns the data shows.

_____

_____

_____

_____

(2)

(iii) How far does the data from the model support the suggestion you made in part **(b)**?

_____

_____

_____

_____

(2)

(d) Describe how blood vessels help control human body temperature.

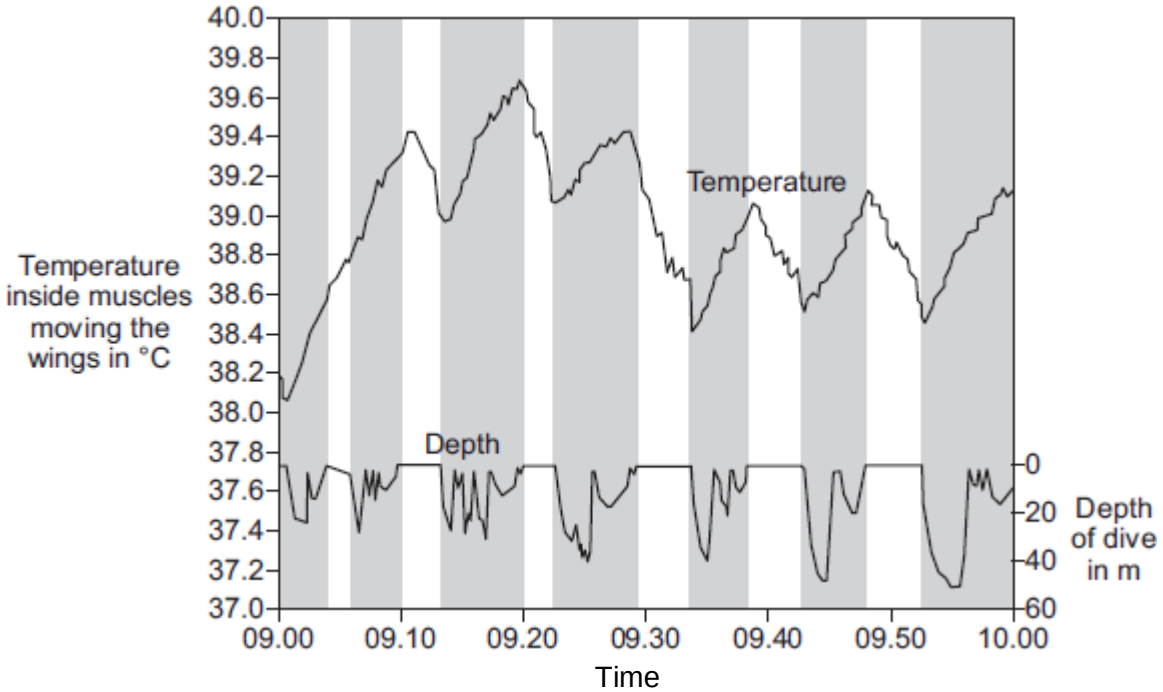
(4)

(e) Penguins control their body temperature in similar ways to humans.
Scientists investigated changes in body temperature of penguins when the penguins were diving to catch fish.

(i) **Graph 1** shows the relationship between the temperature of the muscles moving a penguin's wings and diving.

The shaded areas show when the penguin was diving.

Graph 1



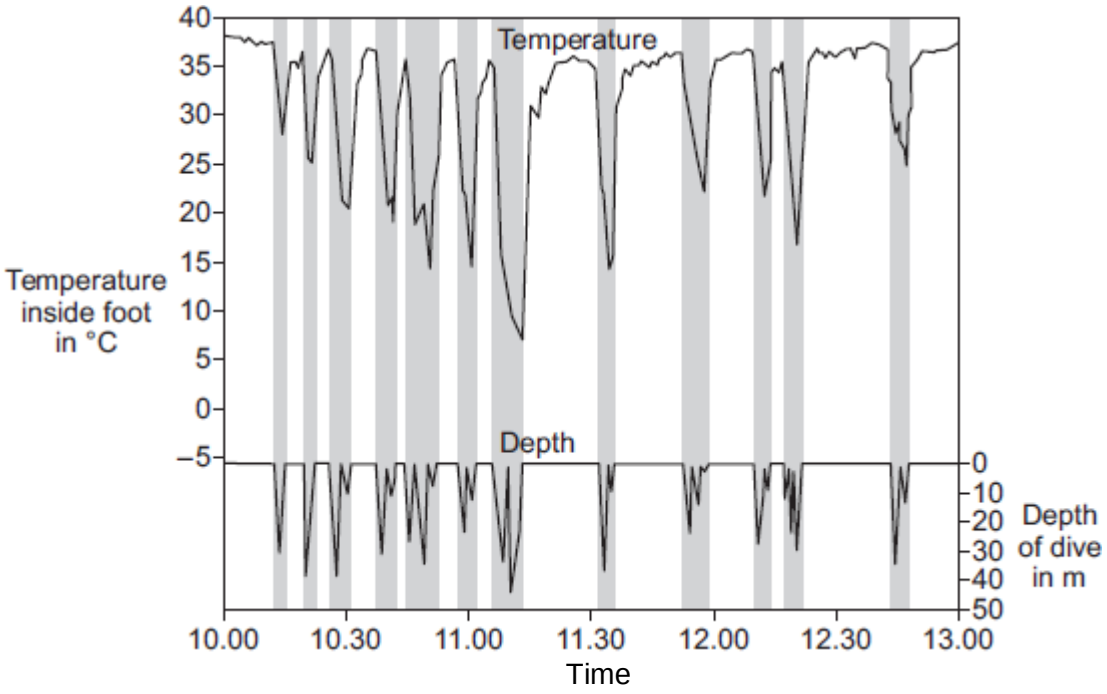
Suggest an explanation for the changes in temperature inside the muscles moving the penguin's wings.

(3)

(ii) **Graph 2** shows the relationship between the temperature inside a penguin's foot and diving.

The shaded areas show when the penguin was diving.

Graph 2



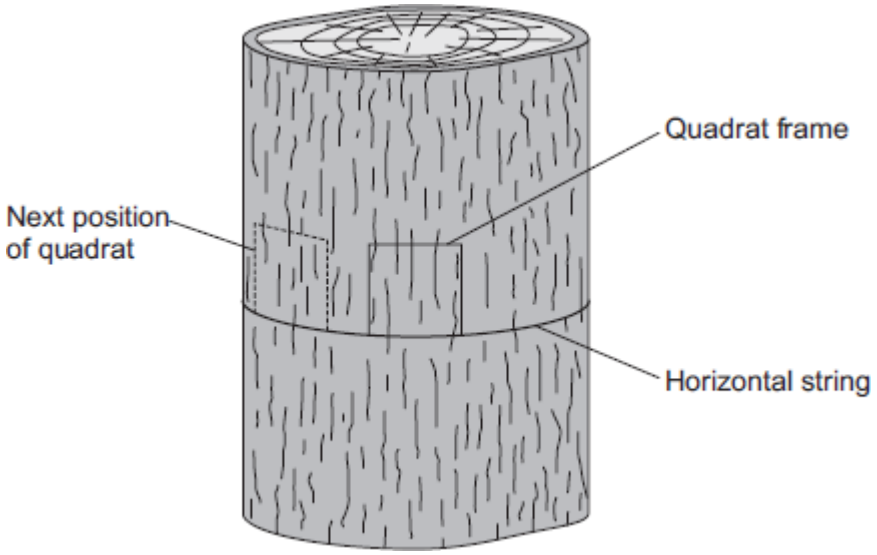
Suggest an explanation for the changes in temperature inside the penguin's foot as it dives.

(3)

(Total 22 marks)

Q35.

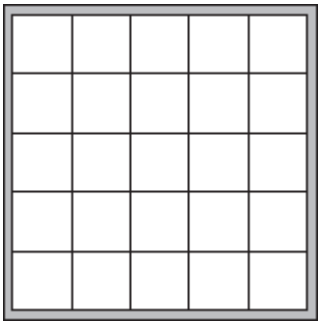
Students investigated the distribution of a green alga on a tree trunk.



The students:

- tied a piece of string horizontally round a tree
- put a quadrat on the string so that the quadrat faced south
- estimated the percentage of the area in the quadrat covered with the green alga
- repeated the observation with the quadrat facing south west, west, north west, north, north east, east and south east.

(a) The diagram shows the quadrat the students used.



Describe how you would estimate the percentage of the area covered with the green alga in one quadrat.

_____

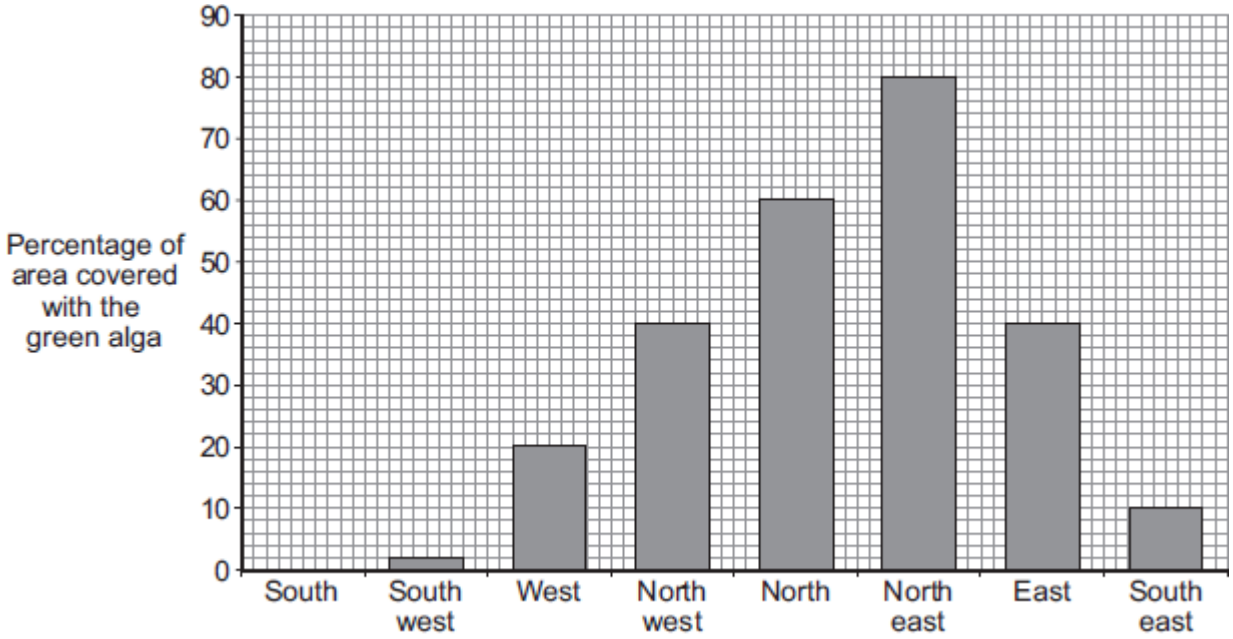
_____

_____

_____

(2)

(b) The bar chart shows the students' results.



(i) How does the direction that the quadrat faced affect the percentage area covered with the green alga?

_____

_____

_____

_____

(2)

(ii) What was the mode of the percentage area covered with the green alga?

Mode = _____ %

Give the reason for your answer.

_____

_____

(2)

(iii) Give **three** environmental factors that might affect the distribution of the green alga on the tree.

1. _____

2. _____

3. _____

(3)

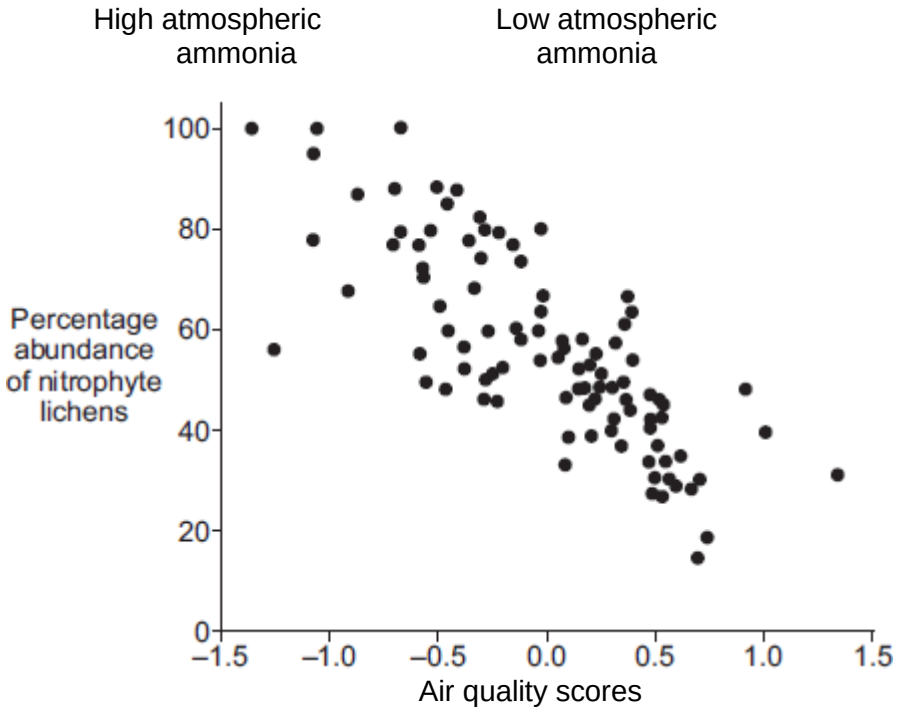
(iv) Suggest how **one** of the factors you gave in part **(b) (iii)** might have caused the distribution of the green alga shown on the bar chart.

Factor _____

_____

(3)

(c) Nitrophyte lichens grow on the bark of trees. These lichens are indicators of air pollution by ammonia. Ammonia concentrations in the atmosphere are often high in agricultural areas.
The graph shows the relationship between air quality and the distribution of nitrophyte lichens.



(i) Describe the relationship between atmospheric ammonia and the abundance of nitrophyte lichens.

(2)

(ii) How useful would a particular value for the abundance of nitrophyte lichens be as an indicator of ammonia pollution of the atmosphere?
Explain your answer.

_____

_____

(2)

(Total 16 marks)

Q36.

Many organisms are adapted to avoid being eaten.

(a) The photograph shows a gecko on a leafy branch.

The gecko is adapted to avoid being eaten by predators.

Explain how.

_____

_____

_____

_____

(2)

(b) Ants can give a painful bite.

The photograph shows a type of ant living on acacia trees.

Acacia trees have thorns on their branches.

Branch of acacia tree.

By Ryan Somma, cropped by Fama Clamosa,
20 January 2010 (UTC) [CC-BY-SA-2.0], via Wikimedia Commons

(i) Predators are less likely to eat ants living on acacia trees than ants living on the ground.

Suggest why.

_____

_____

(1)

(ii) Giraffes eat the leaves of acacia trees.

Giraffes do **not** eat the leaves of acacia trees that have ants living on them.

Suggest why.

_____

_____

(1)

(c) The photographs show a wasp and a hoverfly.

The wasp and the hoverfly both have black and yellow stripes.

Wasp **Hoverfly**

© Alexandr Pakhnyushchyy/iStock © Richard Majlinder/iStock

Wasps have stings, but hoverflies do **not**.

The stripes on the hoverfly help the hoverfly to avoid being eaten by predators.

Explain why.

_____

_____

_____

_____

(2)

(Total 6 marks)

Q37.

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.

(1)

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

Tree bark covered with lichens Tree bark made black by pollution

(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.

characteristic	clone	mutation

A change in genetic material is called a _____

(1)

(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.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(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.

(2)

(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)

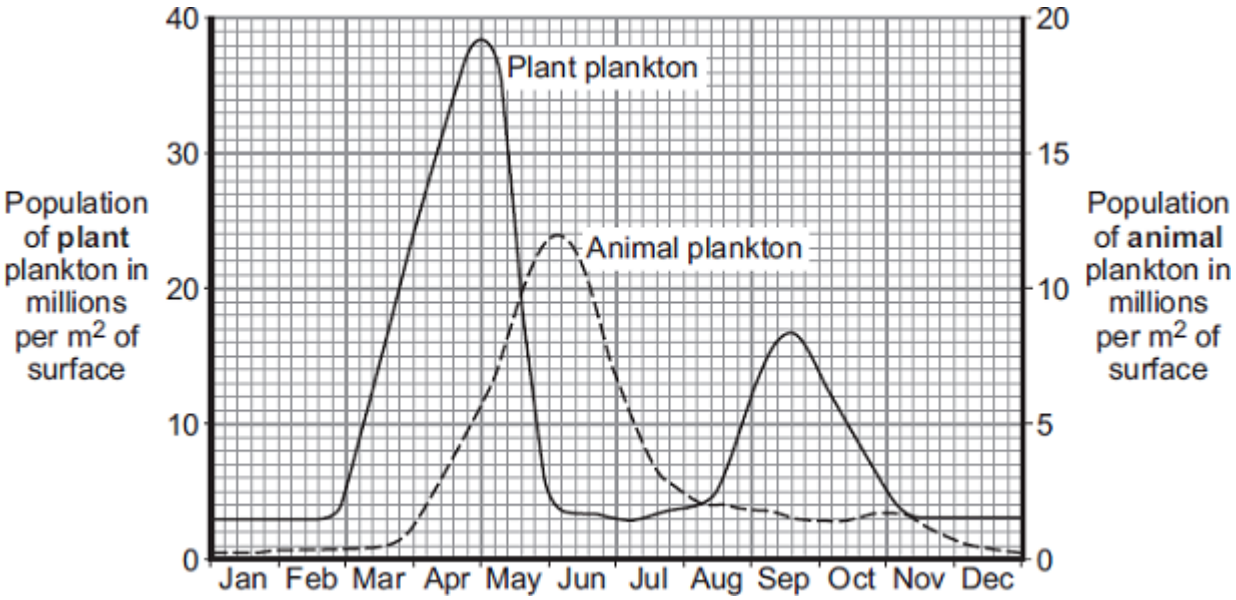
(Total 9 marks)

Q38.

Plankton live in the sea.
Animal plankton eat plant plankton.

Graph 1 shows how the populations of the plankton change through the year in the seas around the UK.

Graph 1



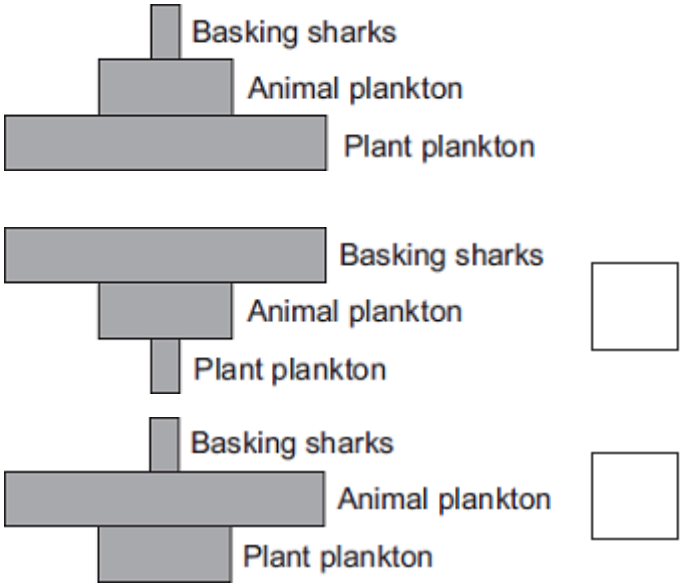
(a) Basking sharks eat animal plankton. Basking sharks grow up to 8 metres long.

Look at the diagram and **Graph 1**.

Which is the correct shape for the pyramid of biomass to show the relationship between
plant plankton, animal plankton and basking sharks, in June?

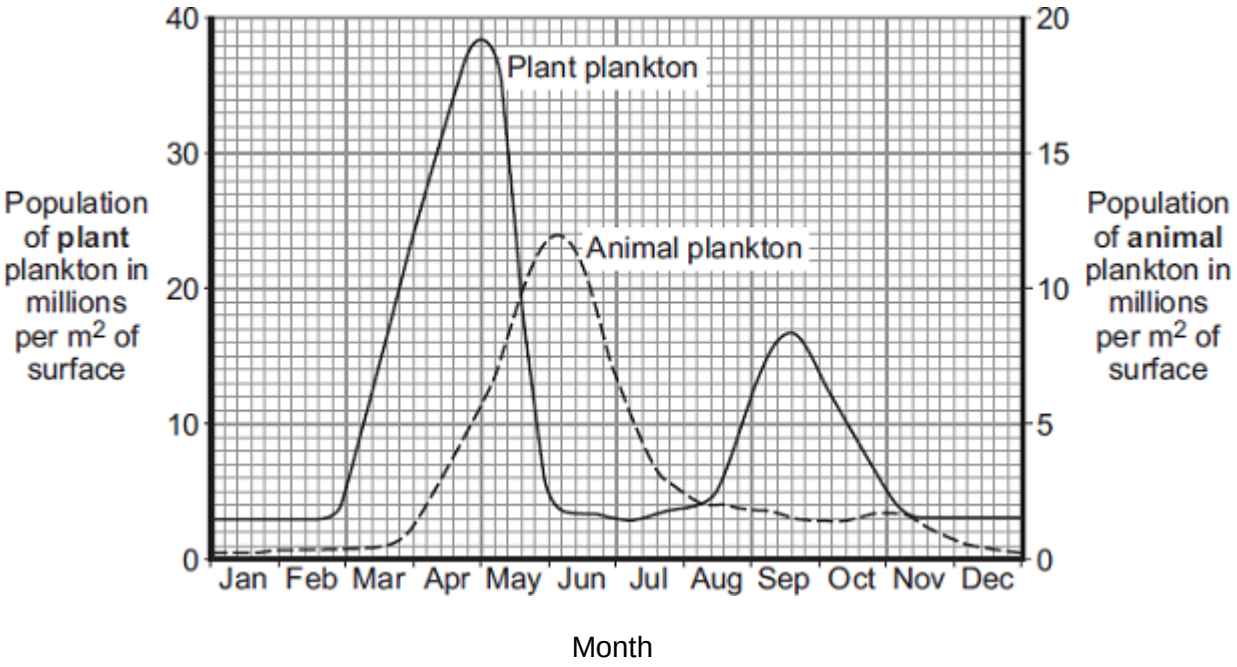
Tick (✓) **one** box.

☐



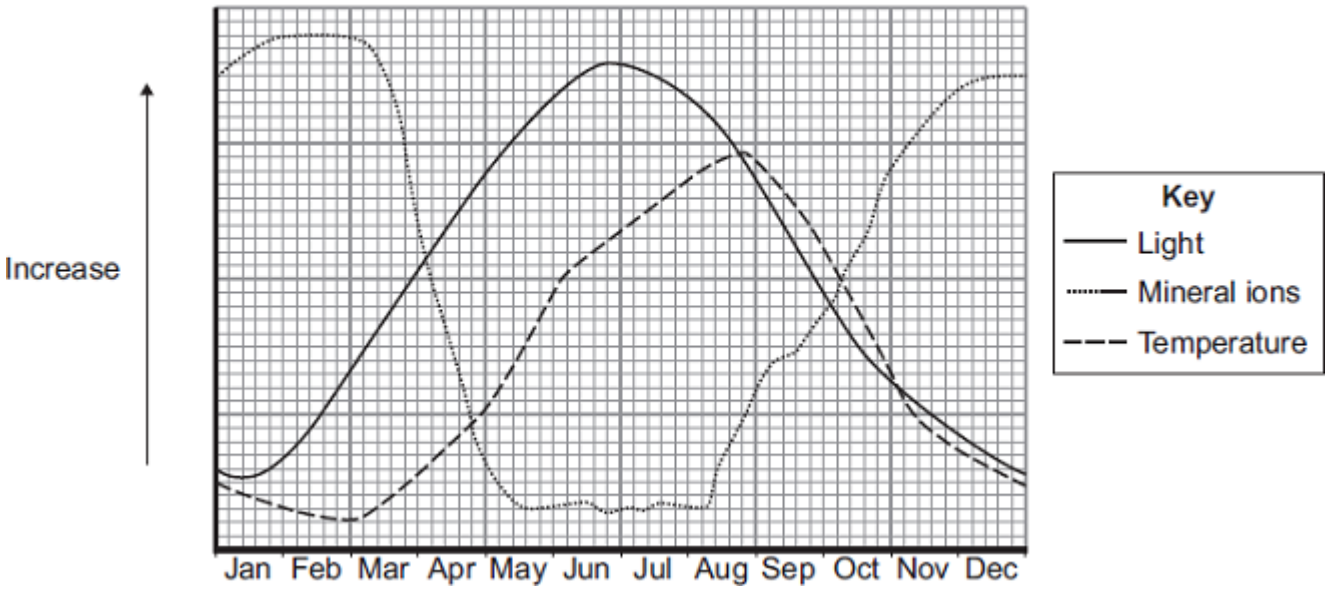
(1)

Graph 1 is repeated here to help you answer the following questions.



Graph 2 shows changes in some of the conditions in the upper layers of the sea around the UK.

Graph 2



(b) The population of plant plankton increases between February and April.

Suggest **one** reason for the increase.

Explain your answer.

_____

_____

_____

_____

(2)

(c) The population of animal plankton changes between April and July.

Suggest explanations for the changes.

_____

_____

_____

_____

_____

(2)

(d) The concentration of mineral ions changes between February and December.

Suggest explanations for the changes.

_____

_____

_____

_____

_____

_____

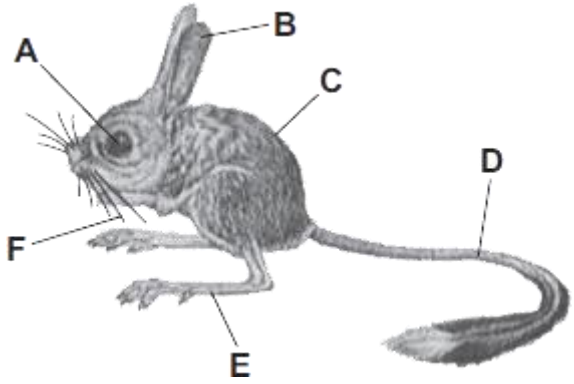
_____

(3)

(Total 8 marks)

Q39.

The drawing shows a jerboa. Jerboas live in sandy deserts.



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 ☐

(1)

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

(1)

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

(1)

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

(1)

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

(1)

(Total 5 marks)

Q40.

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.

_____

_____

_____

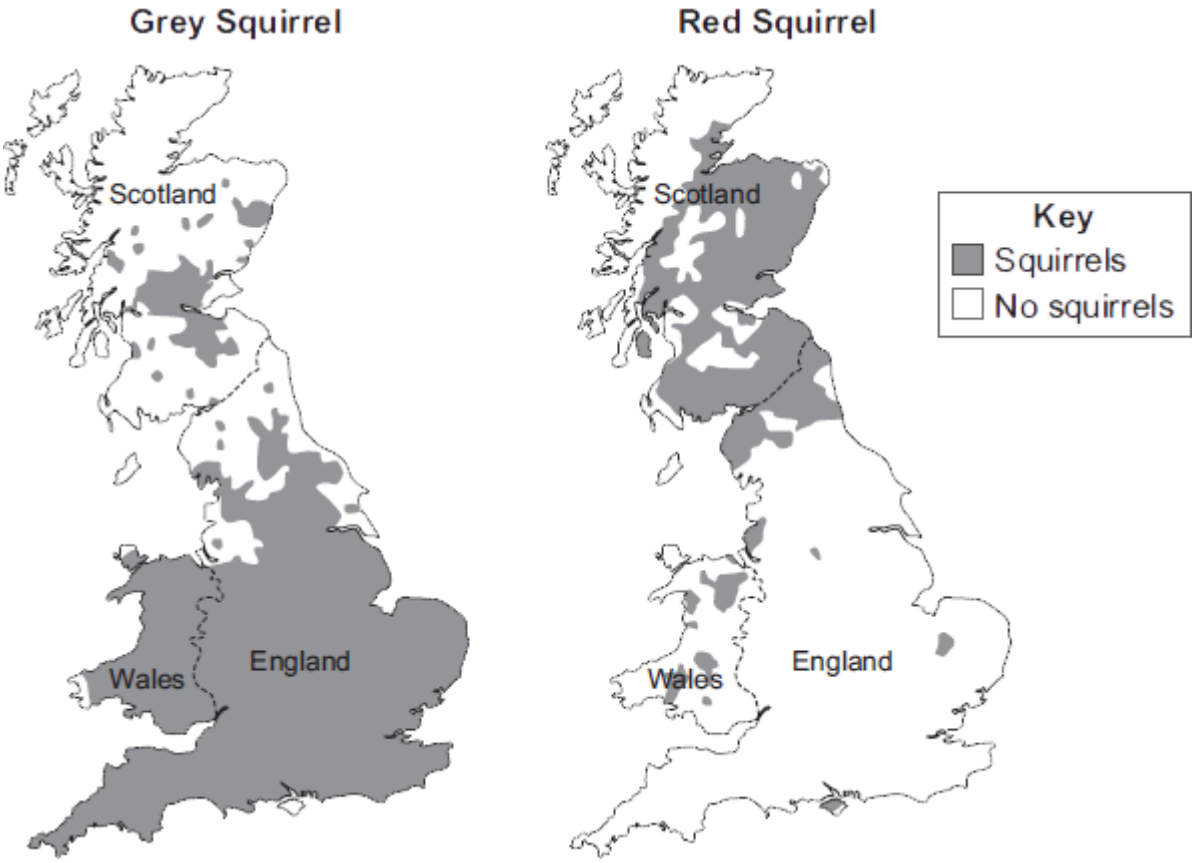
_____

_____

_____

(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**.

_____

_____

_____

_____

_____

_____

_____

_____

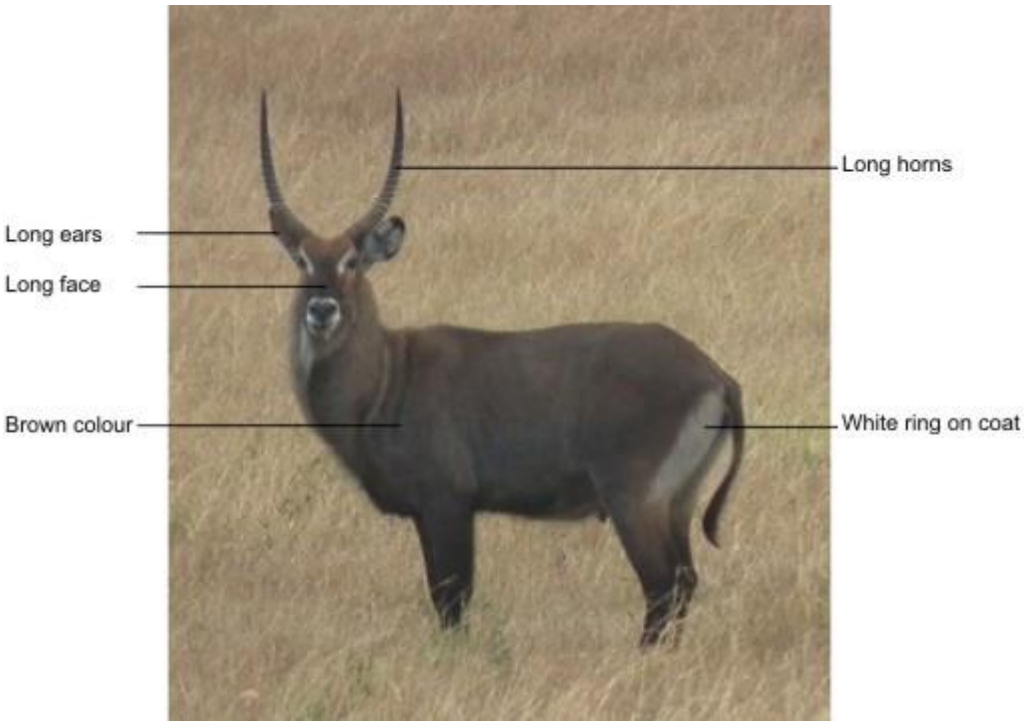
(3)

(Total 7 marks)

Q41.

The photograph shows some features of a waterbuck.

Waterbuck live in areas of tall, brown grass.



By Nevit Dilmen (Own work) [CC-BY-SA-3.0], via Wikimedia Commons

Choose labels from the photograph to answer these questions.
You should choose a label **once** only.

(a) Which feature helps to camouflage the waterbuck in the grass?

_____

(1)

(b) Which feature helps the waterbuck to detect predators?

_____

(1)

(c) Which feature helps the waterbuck to fight predators?

_____

(1)

(d) Which feature helps a baby waterbuck to follow a parent through the long grass?

_____

(1)

(Total 4 marks)

Q42.

An animal called *Tiktaalik* became extinct about 360 million years ago.

The photograph shows the fossilised skeleton of *Tiktaalik* and a model of what scientists think *Tiktaalik* looked like.

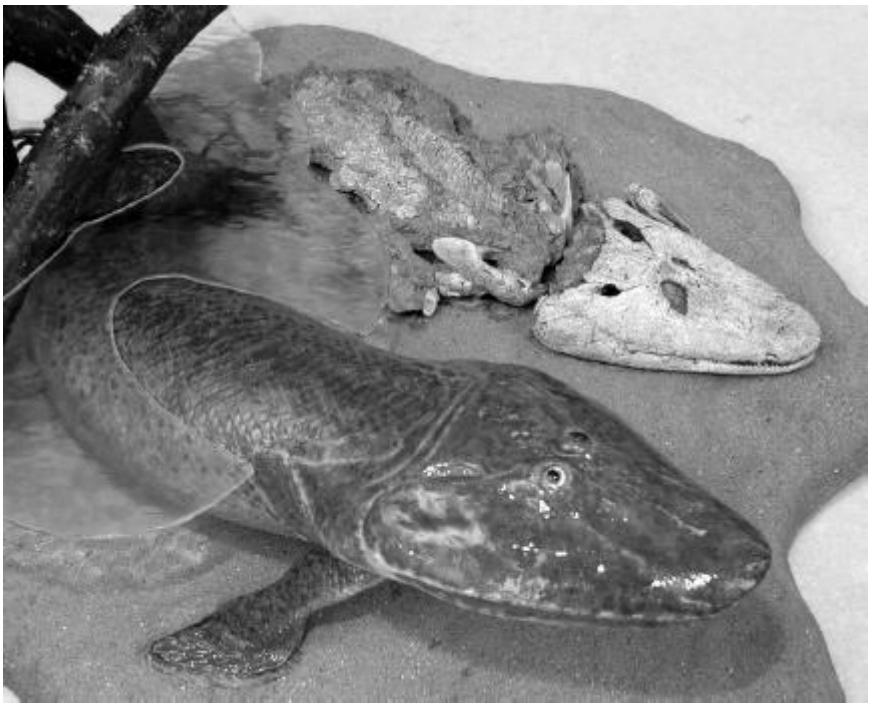


Image © University of Chicago, Shubin Lab. Model by Tyler Keillor

(a) Scientists found only the fossilised skeleton of *Tiktaalik*.

Explain why.

_____

_____

_____

_____

(2)

(b) Scientists think that *Tiktaalik* lived mostly in water, but that it was one of the first animals to be able to move onto land.

Use evidence from the photograph to suggest why.

_____

_____

_____

_____

(2)

(Total 4 marks)

Q43.

Fruits contain seeds. Most plants produce fruits that are adapted for dispersing seeds. Seeds are dispersed so that young plants do not grow near their parents.

(a) Explain the advantage to plants of dispersing their seeds.

_____

(2)

(b) The photograph shows cocklebur fruits.

Photograph by Robert H. Mohlenbrock. Image in the public domain as a work of the U.S. federal government. Courtesy of USDA NRCS Wetland Science Institute.

The photograph is magnified.

Suggest how cocklebur fruits are adapted for dispersing their seeds.

(2)
(Total 4 marks)

Q44.

In a woodland, bluebells grow well every year.

Bluebells growing well in woodland

Mick Garratt [CC-BY-SA-2.0], via Wikimedia Commons

Each year the dead flowers and leaves of the bluebells and leaves from the trees fall onto the ground.
The bluebells do not run out of mineral ions.

Explain why the bluebells do **not** run out of mineral ions.

The words in the box may help you.

roots	**dead leaves**	**mineral ions**
	microorganisms	**decay**

_____

_____

_____

_____

_____

_____

(3)

(Total 3 marks)

Q45.

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

Plants and animals have become adapted in many different ways to reduce the risk of being eaten by predators.

Describe these adaptations.

Give examples of animals and plants adapted in the ways you describe.

(Total 6 marks)

Q46.

Many animals and plants are adapted to stop other organisms eating them.

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

By Forest & Kim Starr [CC BY 3.0], via Wikimedia Commons

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

Adaptation

_____

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

_____

_____

(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.

_____

_____

(2)

(c) The photograph shows some insects.

These insects are bright red.

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)

Q47.

The photograph shows a lionfish. Lionfish are normally found in the Pacific Ocean.

By Albert Kok at nl.wikipedia [Public domain], from Wikimedia Commons

In 1992 six lionfish escaped from an aquarium into the Atlantic Ocean.

Now there are thousands of lionfish in the Atlantic Ocean. Numbers of the native Atlantic fish have gone down because the lionfish have eaten many native Atlantic fish.

Suggest explanations for the large increase in the number of lionfish in the Atlantic Ocean.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

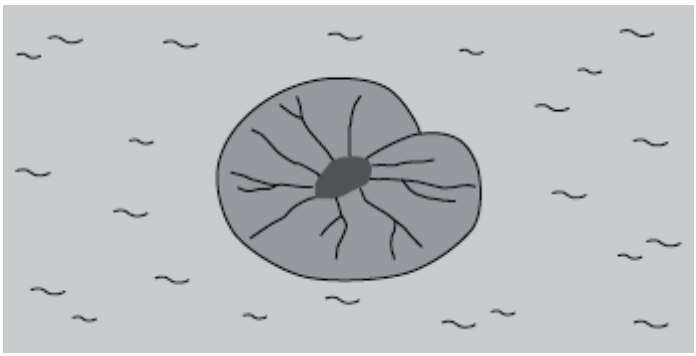
(Total 3 marks)

Q48.

Plants are adapted for survival in many different ways.

Use information from the drawings to answer each question.

(a) This plant lives in ponds. The leaves of the plant float on the surface of the water.



The leaf of this plant is adapted for floating on water.

Suggest how.

_____

_____

(1)

(b) This plant lives in areas where a lot of snow falls.

The triangular shape helps the tree to survive in snowy conditions.

Suggest how.

_____

_____

(1)

(c) This plant has sharp thorns on the stem.

Thorns help this plant survive.

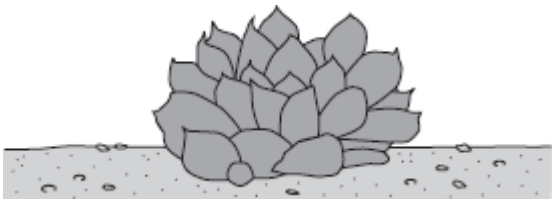
Suggest how.

_____

_____

(1)

(d) This plant lives in very dry areas.



The swollen leaves help this plant to survive in very dry places.

Suggest how.

_____

_____

(1)

(Total 4 marks)

Q49.

In the winter wild birds cannot find food easily.
A student carried out an investigation to find the best kind of food to put out for wild birds in winter.

- She nailed six black dishes to a piece of wood.
- She put 100 g of a different type of seed into each dish.
- She placed the piece of wood in her garden.
- She observed the birds that visited each of the dishes before school, after school and at weekends.
- At the end of the investigation, she weighed the amount of each type of seed remaining.
- She also calculated the percentage of each type of seed that was eaten by the birds.

(a) Name **two** control variables in this investigation.

1. _____

2. _____

(2)

(b) **Table 1** shows the number of bird visits to each dish of seeds that she recorded.

Table 1

Bird species	Number of visits to each dish of seeds

	Corn	Niger	Safflower	Sunflower	Peanut	Millet
Morning Dove	12	10	6	13	2	10
Red-bellied Woodpecker	1	0	0	1	4	0
Dark-eyed Junco	3	6	1	4	0	3
Northern Cardinal	0	0	1	1	2	0
American Goldfinch	0	31	5	18	0	0
House Finch	1	5	23	19	1	3
House Sparrow	16	1	0	4	0	11
Total visits	33	53	36	60	9	27

Which type of seed had visits from the greatest number of **different** bird species?

_____

(1)

(c) **Table 2** shows:
- the percentage of each type of seed eaten
- the percentage of fat in each type of seed.

Table 2

Type of seed	Percentage eaten	Percentage of fat
Corn	68	2
Niger	77	40
Safflower	86	3
Sunflower	91	35
Peanut	4	48
Millet	99	2

(i) The girl concluded that the most popular seeds for the birds were the seeds with the highest percentage of fat.

Was her conclusion justified by the data in **Table 2**?

Draw a ring round your answer. **Yes / No**
Give a reason for your answer.

_____

_____

(1)

(ii) Most winter bird food for sale in shops contains niger and sunflower seeds. Use the information in **Table 1** and **Table 2** to suggest **two** reasons why.

1. _____

_____

2. _____

_____

(2)

(Total 6 marks)

Q50.

Desert plants are adapted for survival in a dry climate.

(a) Joshua trees live in deserts.

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

Joshua trees have two different types of root:

- a system of shallow roots spread out over a large area
- roots about 1 m in diameter, shaped like bulbs, deep in the soil.

Explain the advantage to the Joshua tree of having:

(i) shallow roots spread out over a large area

_____

_____

_____

_____

(2)

(ii) large, bulb-like roots deep in the soil.

_____

_____

(1)

(b) Creosote bushes also live in deserts.

By Sue in az (Own work) [Public domain], via Wikimedia Commons

The leaves of creosote bushes:
- are covered with a layer of wax
- fold together during the day.

Explain how the leaves of the Creosote bush help it to survive in deserts.

_____

_____

_____

_____

_____

_____

(3)
(Total 6 marks)

Q51.

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.

Photograph	Adaptation
	Running very fast
	Swimming
	Flying
	Catching and holding prey
	Supporting a very heavy body

(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 IHooq38 [CC BY-ND 2.0], via Flickr. Supplied by iStockphoto/Thinkstock

Q52.

Animals in a habitat compete with each other.

(a) Give **two** factors for which animals may compete.

1. _____

2. _____

(2)

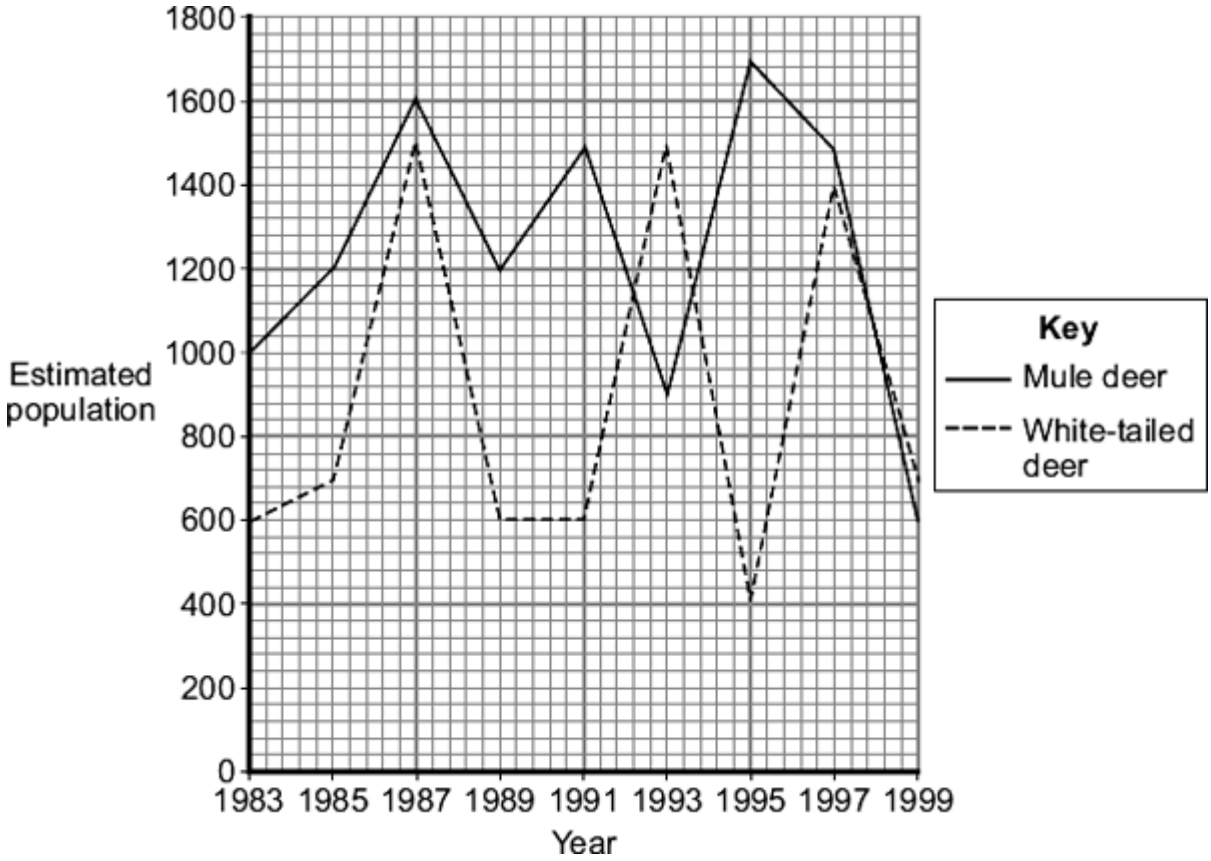
(b) The photographs show a mule deer and a white-tailed deer.

Mule deer **White-tailed deer**

Mule deer by Dcrjsr (Own work) [CC-BY-3.0], via Wikimedia Commons. White-tailed deer by Clay Heaton (Own work) [CC-BY-SA-3.0], via Wikimedia Commons

Mule deer and white-tailed deer live together in the same national park in the USA.

The graph shows changes in the populations of the two deer species between 1983 and 1999.



(i) Describe the changes in the population of white-tailed deer between 1991 and 1995.

_____

_____

_____

_____

(2)

(ii) Use information from the graph to suggest an explanation for changes in the population of white-tailed deer between 1991 and 1995.

_____

_____

_____

_____

(2)

(Total 6 marks)

Q53.

The photograph shows a snowy owl.

By Neil McIntosh from Cambridge,United Kingdom
(Snowy Owl uploaded by Magnus Manske)[CC-BY-2.0],
via Wikimedia Commons

- The snowy owl lives in the Arctic.
- It eats small mammals such as mice.

How does each of the following adaptations help the snowy owl to survive?

(a) Its feathers are white.

_____

_____

(1)

(b) It has a thick covering of feathers.

_____

_____

(1)

(c) It makes no sound when it flies.

_____

_____

(1)

(d) It has long, sharp claws.

_____

_____

(1)

(Total 4 marks)

Q54.

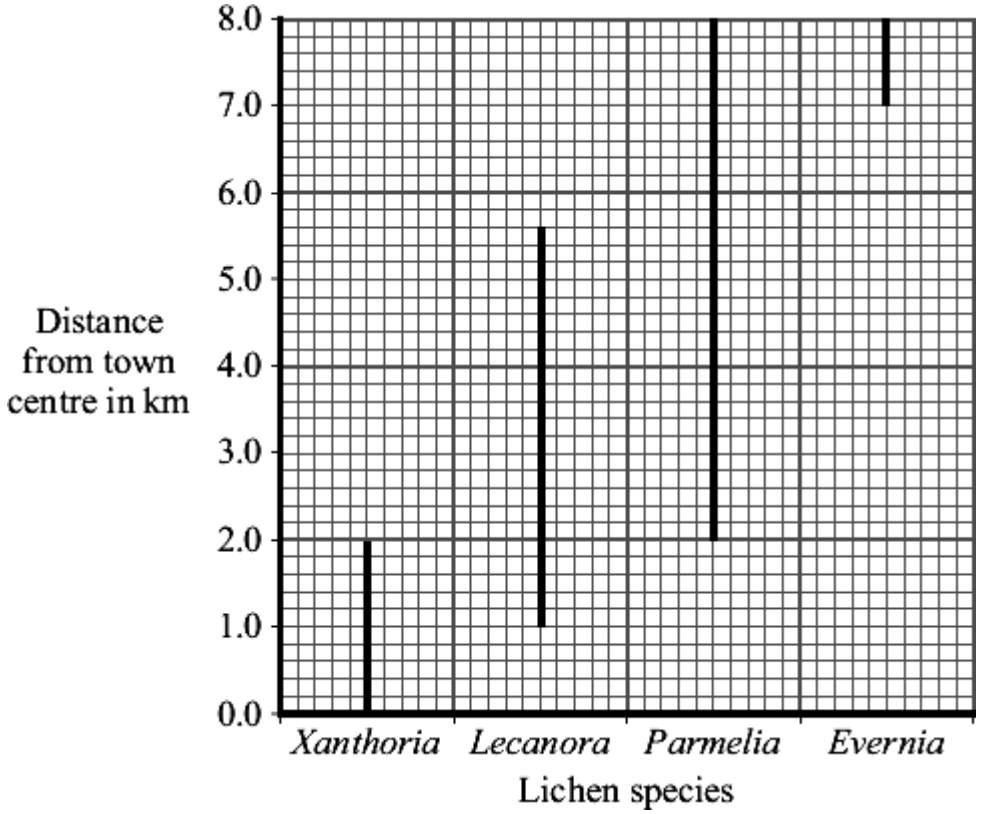
Lichens are sensitive to the amount of sulfur dioxide in the atmosphere. They are used as indicator species for the amount of air pollution. Air pollution is generally higher in town centres than in the countryside.

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.

_____

_____

(1)

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

_____

(1)

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

_____

(1)

(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. _____

_____

2. _____

_____

(2)

(Total 5 marks)

Q55.

The photograph shows a musk ox.

Photograph supplied by iStockphoto/Thinkstock

The musk ox lives in the Arctic. An adult musk ox is 2.5 m long and 1.4 m high at the shoulder. Adults usually have a mass of about 400 kg.

Use this information and information from the photograph to explain **two** ways in which a musk ox is adapted for survival in the Arctic.

(a) (i) Adaptation 1 _____

(1)

(ii) How this adaptation helps the musk ox to survive in the Arctic.

_____

_____

(1)

(b) (i) Adaptation 2 _____

(1)

(ii) How this adaptation helps the musk ox to survive in the Arctic.

_____

_____

(1)

(Total 4 marks)

Q56.

The photograph shows an aardvark.

By Beige Alert [CC BY 2.0], via Flickr

- Aardvarks feed on insects that they dig from the soil.
- Aardvarks hunt for these insects at night.

How does each of these adaptations help the aardvark?

(a) It has powerful claws.

_____

_____

(1)

(b) It has a long, sticky tongue.

_____

_____

(1)

(c) It has very large ears.

_____

_____

(1)

(d) It can cover the end of its nose with flaps of skin.

_____

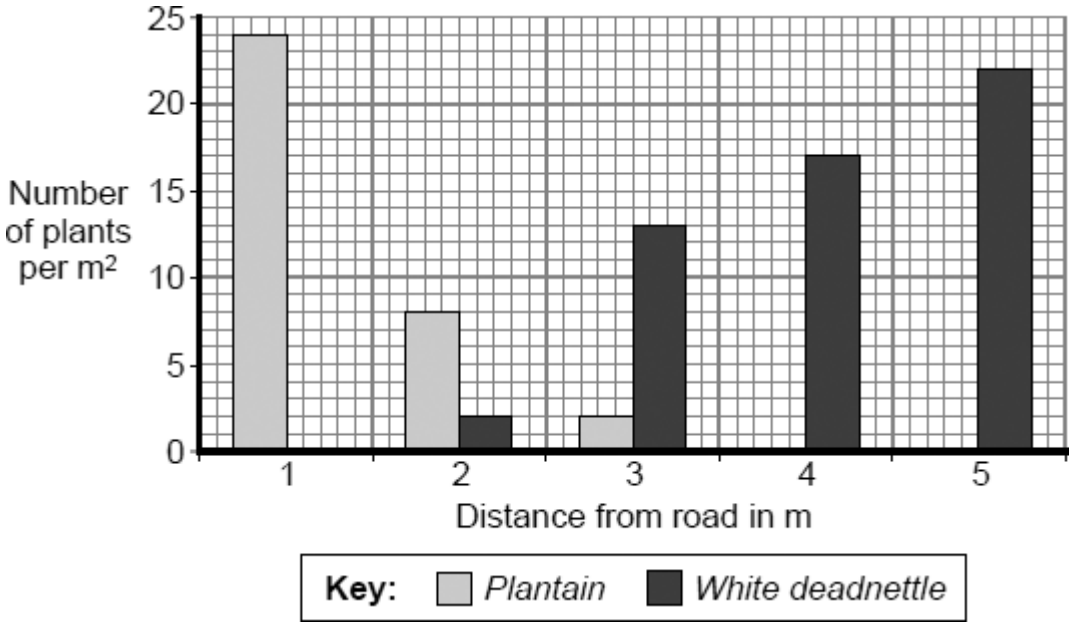
_____

(1)

(Total 4 marks)

Q57.

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



(a) (i) Name the piece of apparatus used in sampling a $1m^2$ piece of land.

_____

(1)

(ii) Describe how this piece of apparatus could be used to obtain the data shown in the bar chart.

_____

_____

_____

_____

_____

(2)

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

_____

_____

_____

(1)

(b) Suggest explanations for:

(i) the distribution of the *White deadnettle* plants

_____

_____

_____

_____

_____

(2)

(ii) the distribution of the *Plantain* plants.

_____

_____

_____

_____

_____

(2)

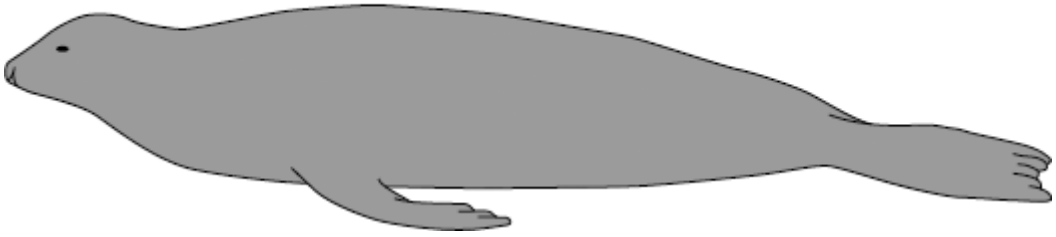
(Total 8 marks)

Q58.

Seals are adapted for life in the sea.
Use information from the drawings to answer the questions.

This drawing shows seal **X**.

Seal X



(a) Give **two** ways in which seal **X** is adapted for swimming.

1. _____

_____

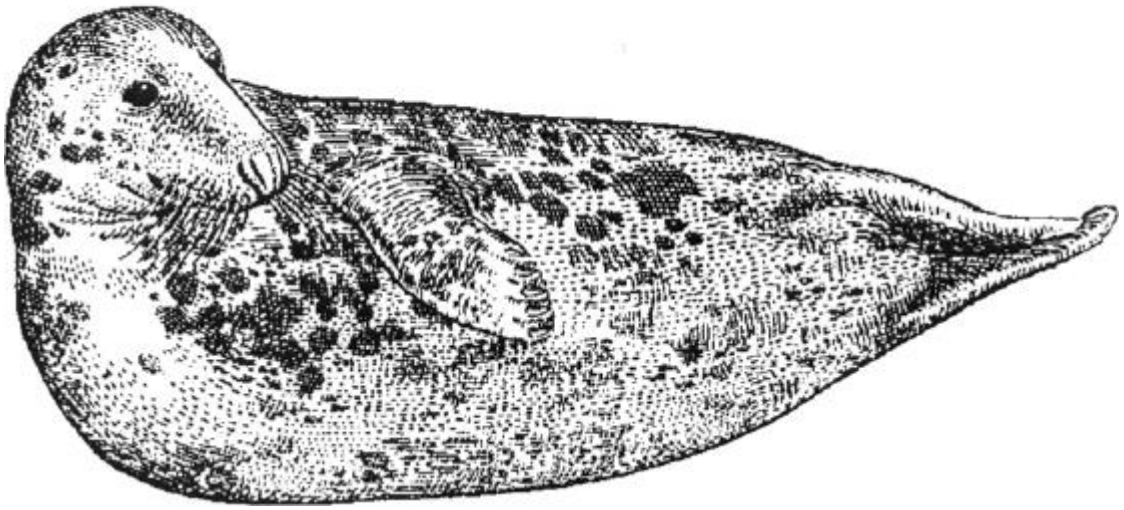
2. _____

_____

(2)

(b) This drawing shows seal **Y**, drawn to the same scale as seal **X**.

Seal Y



Seal **Y** lives in much colder seas than seal **X**.

Explain **one** way in which seal **Y** is adapted for surviving in cold seas.

_____

_____

_____

_____

(2)
(Total 4 marks)

Q59.

Animals have adaptations that enable them to survive.

(a) The photograph shows an echidna.

The echidna has pointed spines on its back.

Explain how these spines might help the echidna to survive.

_____

_____

_____

_____

_____

(2)

(b) The photograph shows a caterpillar.

Explain how the caterpillar's appearance might help it to survive.

_____

_____

_____

_____

_____

(2)

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

(i) Evolution can be explained by a theory called

genetic engineering
mutation
natural selection

.

(1)

(ii) This theory was suggested by a scientist called Charles

Darwin
Lamarck
Semmelweiss

.

(1)

(iii) This scientist said that all living things have evolved from

monkeys
dinosaurs
simple life forms

.

(1)

(d) Many religious people oppose the theory of evolution.

Give **one** reason why.

_____

_____

(1)

(Total 8 marks)

Q60.

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

_____

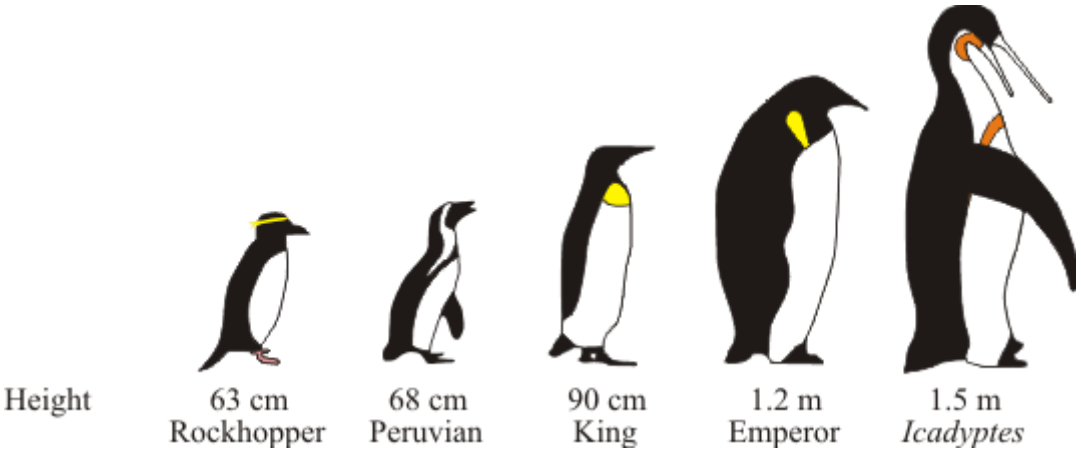
_____

(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)