

Adaptations, Interdependence and Competition

These practice questions can be used by students and teachers and is suitable for GCSE AQA Biology topic Questions 8641

Level: GCSE AQA Biology 8641

Subject: Biology

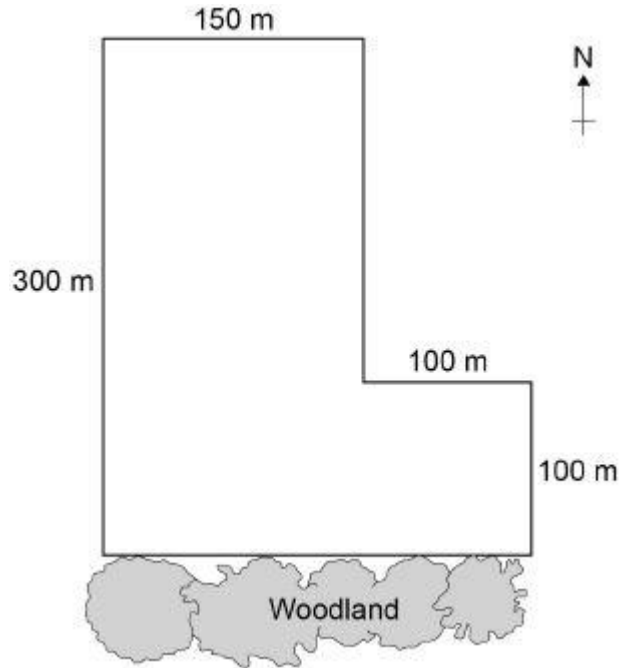
Exam board: GCSE AQA

Topic: Adaptations, Interdependence and Competition

Q1.

Some students investigated the size of a population of dandelion plants in a field.

The diagram below shows the field.



The students:

- placed a 1 m × 1 m square quadrat at 10 random positions in the field
- counted the number of dandelion plants in each quadrat.

The table below shows the students' results.

Quadrat number	Number of dandelion plants
1	6
2	9
3	5
4	8
5	0
6	10
7	2
8	1

(6)

(d) Light is an environmental factor that affects the growth of dandelion plants.

Give **two** other environmental factors that affect the growth of dandelion plants.

1.

2.

(2)

(Total 14 marks)

Q2.

Cell division is needed for growth and for reproduction.

(a) The table below contains three statements about cell division.

Complete the table.

Tick **one** box for each statement.

Statement	Statement is true for		
	Mitosis only	Meiosis only	Both mitosis and

			meiosis
All cells produced are genetically identical			
In humans, at the end of cell division each cell contains 23 chromosomes			
Involves DNA replication			

(2)

Bluebell plants grow in woodlands in the UK.

- Bluebells can reproduce sexually by producing seeds.
 - Bluebells can also reproduce asexually by making new bulbs.
- (b) One advantage of asexual reproduction for bluebells is that only **one** parent is needed.

Suggest **two** other advantages of asexual reproduction for bluebells.

1.

2.

(2)

- (c) Explain why sexual reproduction is an advantage for bluebells.

(4)
(Total 8 marks)

Q3.

Figure 1 shows a ring-tailed lemur.

Figure 1



The table below shows part of the classification of the ring-tailed lemur.

Classification group	Name
Kingdom	<i>Animalia</i>
Phylum	<i>Chordata</i>

	<i>Mammalia</i>
	<i>Primates</i>
	<i>Lemuroidea</i>
Genus	<i>Lemur</i>
	<i>catta</i>

(a) Complete the table above to give the names of the missing classification groups. (2)

(b) Give the binomial name of the ring-tailed lemur.

Use information from the table above.

(1)

Lemurs are only found on the island of Madagascar.

Madagascar is off the coast of Africa.

Scientists think that ancestors of modern lemurs evolved in Africa and reached Madagascar about 50-60 million years ago.

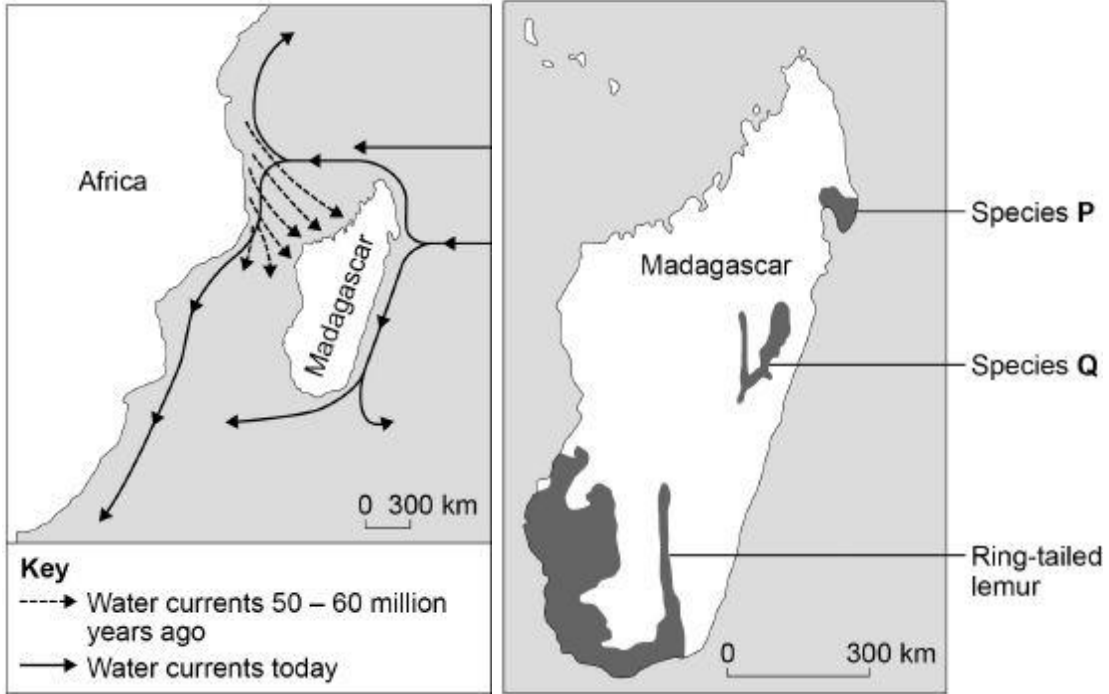
Today there are many species of lemur living on Madagascar.

Figure 2 shows information about water currents.

Figure 3 shows the distribution of three species of lemur on Madagascar.

Figure 2

Figure 3



(c) Suggest how ancestors of modern lemurs reached Madagascar.

(1)

(d) Describe how the ancestors of modern lemurs may have evolved into the species shown in **Figure 3**.

Charles Darwin

Gregor Mendel

(1)

The stone plant, *Lithops bromfieldi*, is adapted to live in very dry deserts.

Figure 1 shows several stone plants.

Figure 1



(b) Give the genus to which the stone plant belongs.

(1)

(c) The stone plant has many adaptations that help it to survive in the desert.

Draw **one** line from each adaptation to how the adaptation helps the stone plant to survive.

Adaptation	How the adaptation helps survival
Plants look like stones	Can trap a lot of light
Leaves with thick, waxy cuticles	Absorb water from deep in the ground
Many long, branching roots	Help cross-pollination
Thick, fleshy leaves	Are not easy to see and so are not eaten
	Reduce water loss
	Store water

(4)

The jerboa is a small desert animal.

Figure 2 shows a jerboa.

Figure 2



The jerboa is adapted for survival in the desert.

The jerboa spends the daytime in its underground burrow.

The jerboa only leaves its burrow to look for food during the night.

(d) Describe how these adaptations help the jerboa to survive in the desert.

(2)

(e) What type of adaptations are described in Question (d)?

Tick **one** box.

Behavioural

Functional

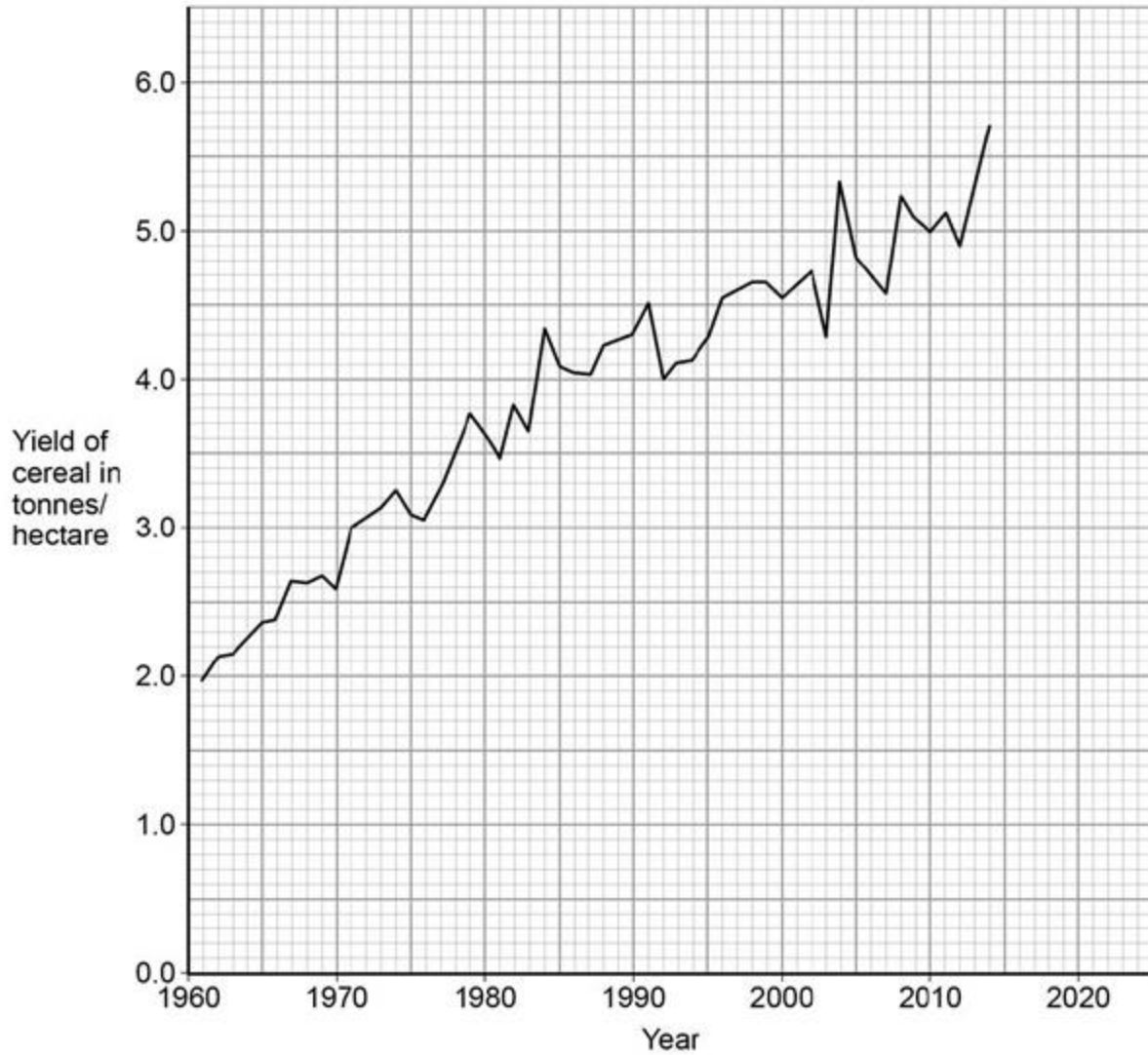
Structural

(1)

(Total 9 marks)

Q5.

The graph shows information about the yield of cereal crops grown in the European Union.



- (a) Calculate the increase in the yield of cereal between 1970 and 2010.

Increase in yield = _____ tonnes/hectare

(2)

- (b) Estimate by what fraction the yield of cereal increased between 1971 and 1992.

Tick **one** box.

$\frac{1}{10}$	<input type="checkbox"/>	$\frac{1}{3}$	<input type="checkbox"/>	$\frac{1}{2}$	<input type="checkbox"/>	$\frac{3}{4}$	<input type="checkbox"/>
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(1)

- (c) The increase in yield is partly due to increased use of nitrate fertilisers.
Which substance do plants make using nitrate ions?

Tick **one** box.

Cellulose	<input type="checkbox"/>
Fat	<input type="checkbox"/>
Protein	<input type="checkbox"/>
Starch	<input type="checkbox"/>

(1)

- (d) The yield of cereal in 2004 was much greater than the yield in 2003.
Suggest **three** possible reasons for the increased yield in 2004.

Tick **three** boxes.

A genetically-modified variety of seed was sown in 2004.	<input type="checkbox"/>
A pathogenic fungus grew on the cereal in 2004.	<input type="checkbox"/>
Farmers added more nitrate to the soil in 2003.	<input type="checkbox"/>
More cereal seeds were sown in 2003.	<input type="checkbox"/>
More rain fell in spring and early summer in 2004.	<input type="checkbox"/>
The mean summer temperature was lower in 2003.	<input type="checkbox"/>

Humans eat cereals.

Humans also eat the animals that feed on cereals.

Figure 1 and **Figure 2** show two food chains.

Figure 1

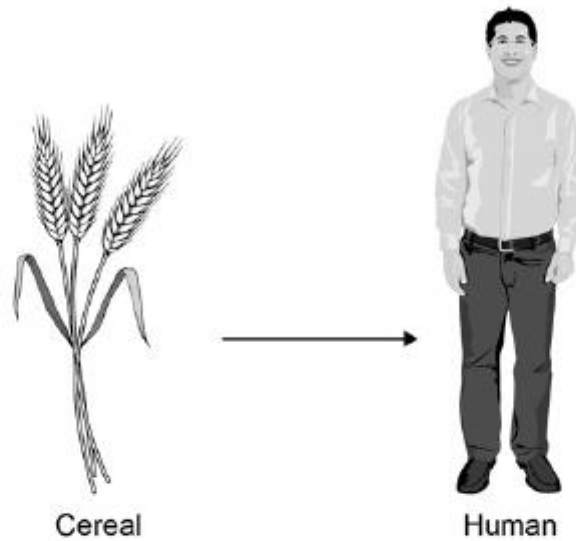
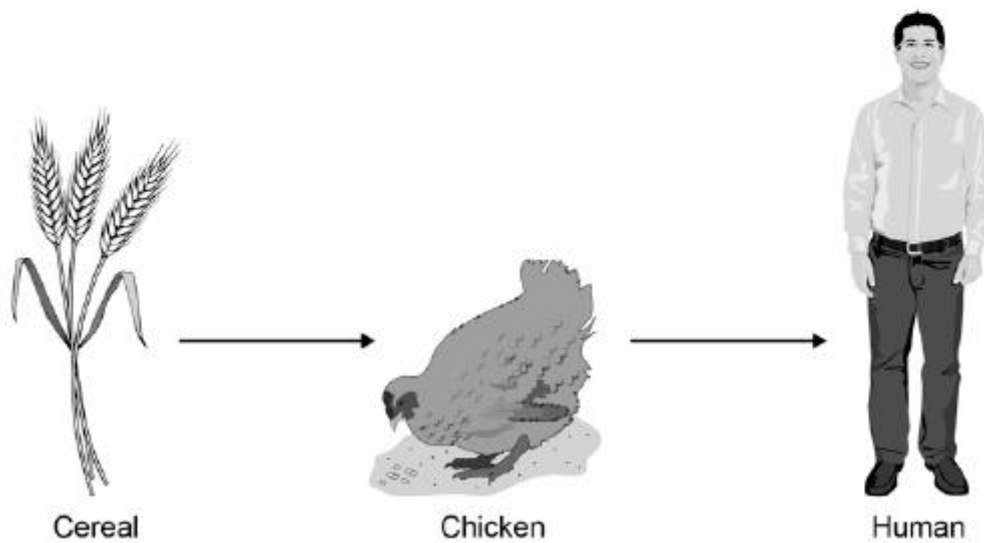
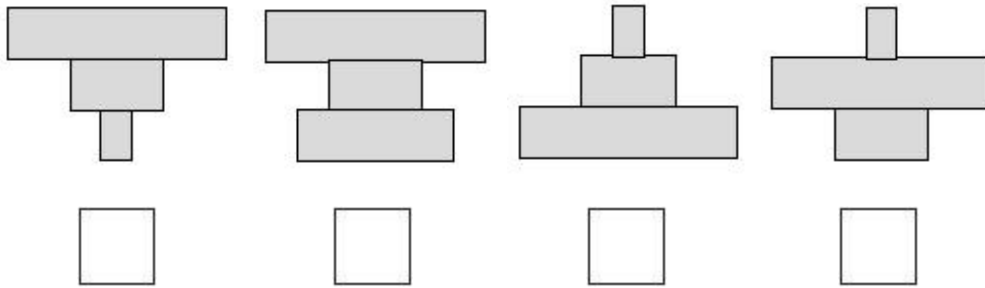


Figure 2



(e) Which pyramid of biomass is correct for the food chain shown in **Figure 2**?

Tick **one** box.



In **Figure 1**, 1 hectare of cereal crop would provide enough energy for 8 people for a year.

In **Figure 2**, 10 hectares of cereal crop would be needed to provide enough energy for only 1 person for a year.

- (f) It is much more efficient for humans to get energy by eating cereals than by eating chickens.

Calculate how many times more efficient.

Answer = _____ times

(1)

- (g) Why is it more efficient for humans to get energy by eating cereals than by eating chickens?

Tick **two** boxes.

Cereals gain extra energy from mineral ions in the soil.

Chickens contain more protein per gram than cereals.

Chickens use energy for movement and for keeping warm.

Much of the food eaten by chickens is wasted as faeces.

Not all parts of the cereal plants are edible.



(2)
(Total 11 marks)

Q6.

The limpet is a snail-like animal that lives attached to a rock on the seashore.

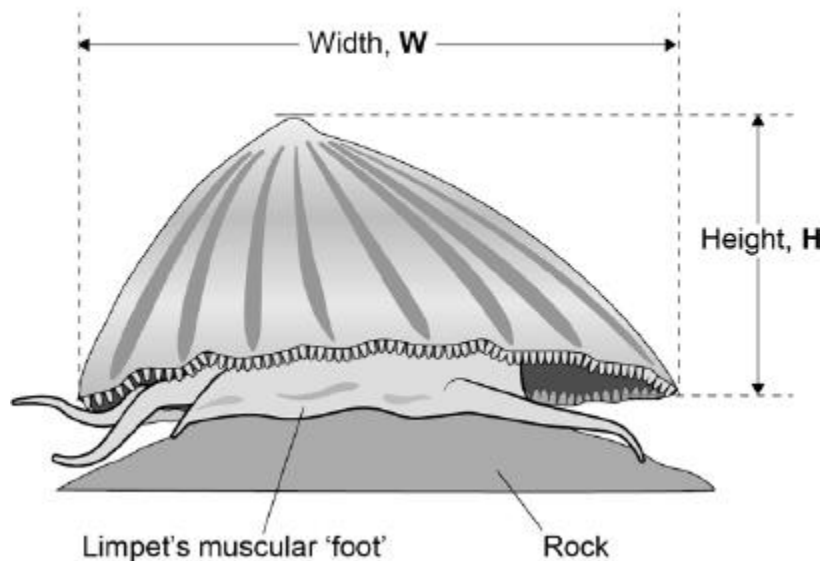
Some students investigated variation in the size of limpets living on two seashores:

- one shore was in a sheltered bay
- the other shore was exposed to the full force of the sea.

The students measured the heights (**H**) and widths (**W**) of 60 limpets on each shore.

Figure 1 shows a limpet and the measurements made by the students.

Figure 1



- (a) On each shore, the students measured a large number of limpets at random locations.

Explain why the students did this.

Large number of limpets:

Random locations:

(2)

The students calculated $\frac{H}{W}$ for each limpet.

The table below shows the students' results.

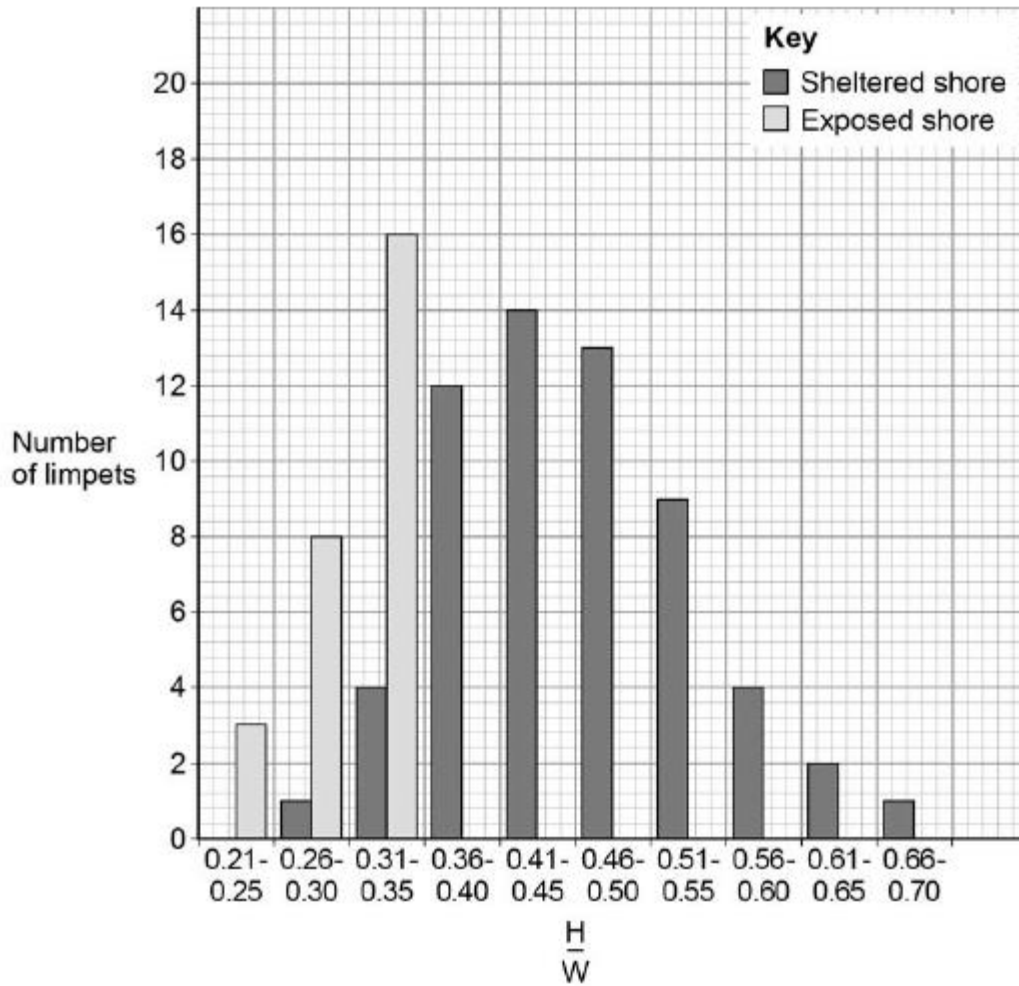
$\frac{H}{W}$	Sheltered shore		Exposed shore	
	Score	Number	Score	Number
0.21 – 0.25				3
0.26 – 0.30		1		8
0.31 – 0.35		4		16
0.36 – 0.40		12		
0.41 – 0.45		14		
0.46 – 0.50		13		
0.51 – 0.55		9		
0.56 – 0.60		4		
0.61 – 0.65		2		
0.66 – 0.70		1		

(b) Complete the table above.

(1)

Figure 2 shows some of the results.

Figure 2



(c) Complete **Figure 2**.

(1)

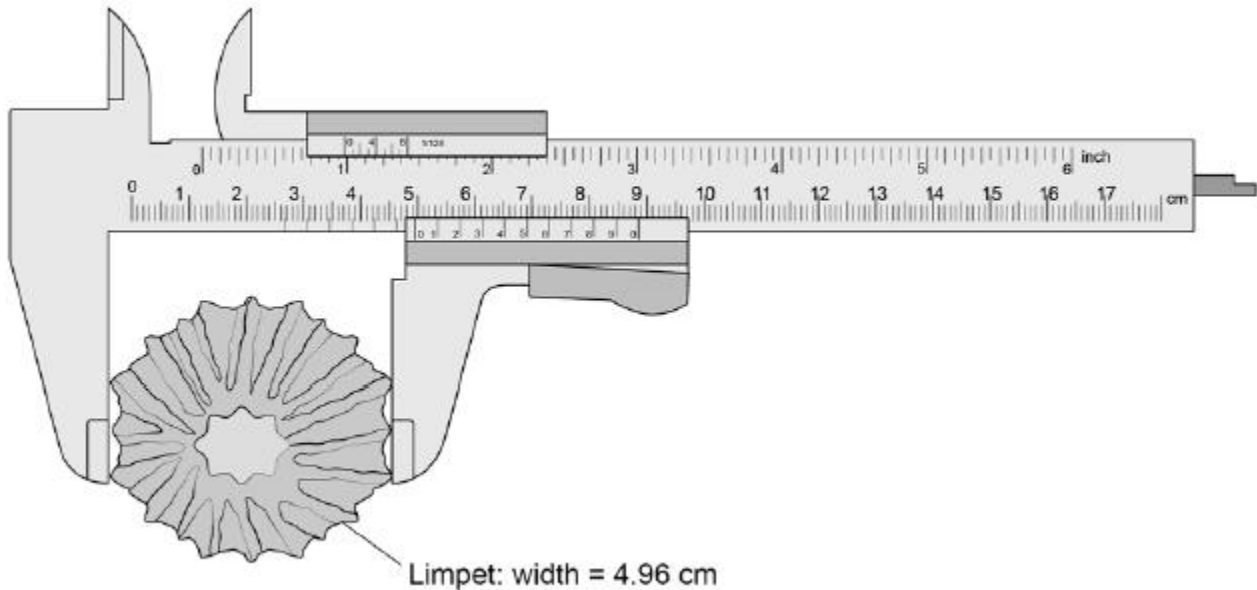
(d) Compare the patterns in the results for the exposed shore and the sheltered shore.

Use information from **Figure 2**.

(3)

Figure 3 shows how the students measured the width of a limpet with a vernier calliper.

Figure 3



(e) One student recorded

- sheltered shore: mean $\frac{H}{W} = 0.4659182$
- exposed shore: mean $\frac{H}{W} = 0.3542183$

The student's teacher stated that the data did **not** justify such a high number of decimal places.

Give the **two** mean values corrected to an appropriate number of decimal places.

Sheltered shore: mean $\frac{H}{W} =$ _____

Exposed shore: mean $\frac{H}{W}$ = _____

(2)

- (f) A limpet clings to a rock on the sea shore using its muscular 'foot', as shown in **Figure 1**.

Scientists have found that limpets can exert a force of 2 newtons / cm² of 'foot'.

To remain attached to its rock, a limpet must exert a force at least as large as the force of the waves.

Calculate the maximum wave force the limpet shown in **Figure 3** could withstand without being knocked off its rock.

Assume that the surface of the foot is a circle.

The area of a circle is πr^2 .

Take the value of π to be 3.14.

Maximum wave force = _____ newtons

(3)

- (g) Suggest **two** reasons why your answer to Question (e) might **not** be very accurate.

1.

2.

(2)

- (h) Suggest biological reasons for the lower mean $\frac{H}{W}$ values for limpets on the exposed shore.

(3)

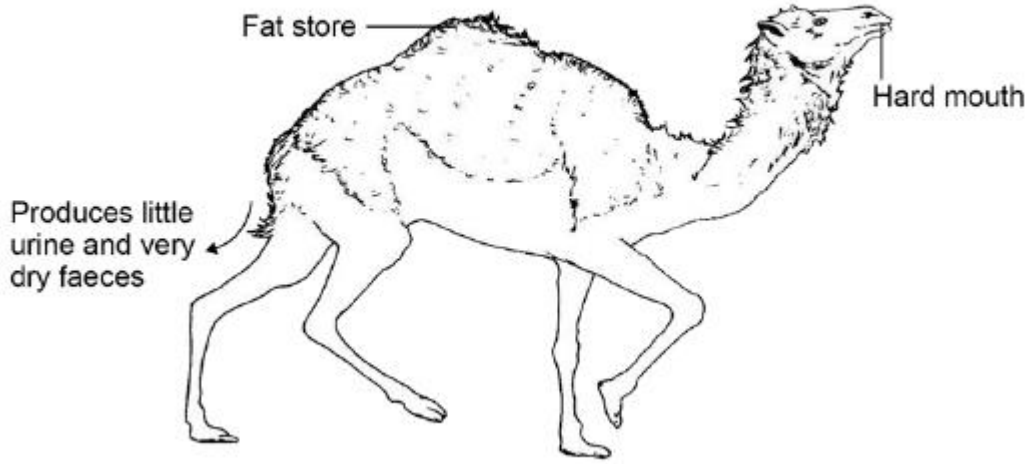
(Total 17 marks)

Q7.

Figure 1 shows a type of camel called a dromedary (*Camelus dromedarius*).

The dromedary lives in hot, dry deserts.

Figure 1



- (a) One adaptation of the dromedary is 'temperature tolerance'.

This means that the animal's body temperature can rise by up to 6 °C before it starts to sweat.

Explain how temperature tolerance can help the dromedary to survive in the desert.

(2)

- (b) Three more adaptations of the dromedary are given in **Figure 1**.

Give a reason why each adaptation helps the animal survive in the desert.

Fat store

Produces little urine and very dry faeces

Hard mouth

(3)

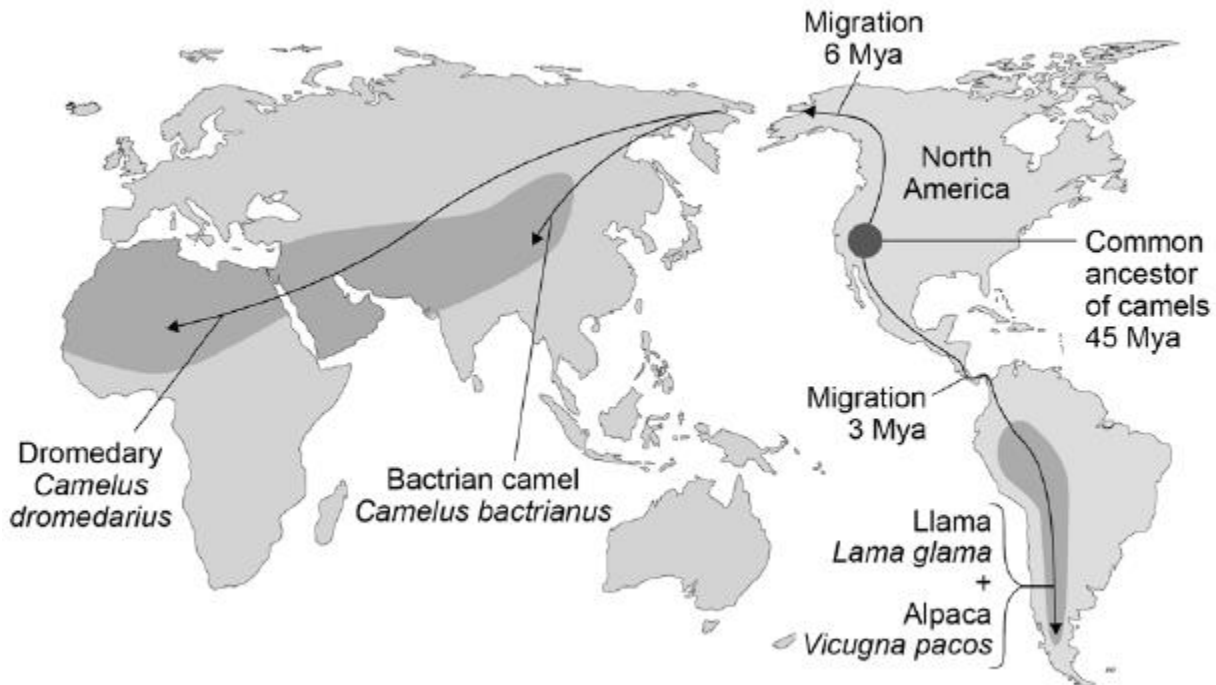
There are several species of the camel family alive today.

Scientists think these species evolved from a common ancestor that lived in North America about 45 million years ago (Mya).

Figure 2 shows:

- where four modern species of the camel family live today
- how the ancestors of these camels migrated from North America.

Figure 2



(c) Which **two** of the four modern species of camel do scientists believe to be

most closely related to each other?

Give the reason for your answer.

_____ and _____

Reason

(1)

- (d) Describe the type of evidence used for developing the theory of camel migration shown in **Figure 2**.

(2)

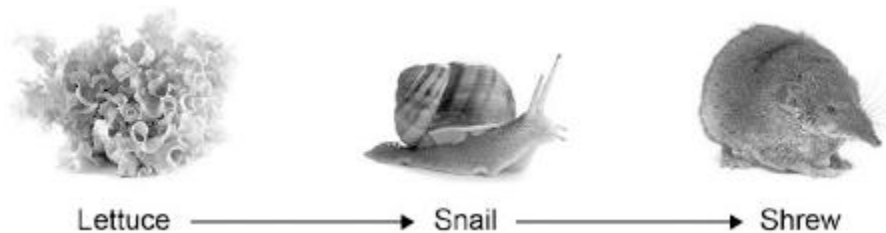
- (e) Explain how several different species of camel could have evolved from a common ancestor over 45 million years.

(6)

(Total 14 marks)

Q8.

The diagram below shows a food chain in a garden.



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

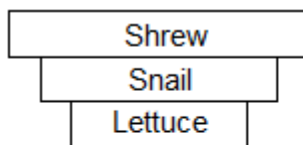
Population

Territory

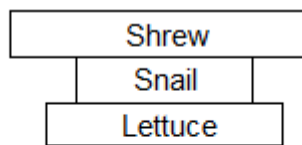
(1)

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

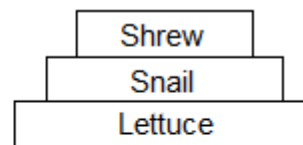
Tick **one** box.



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.

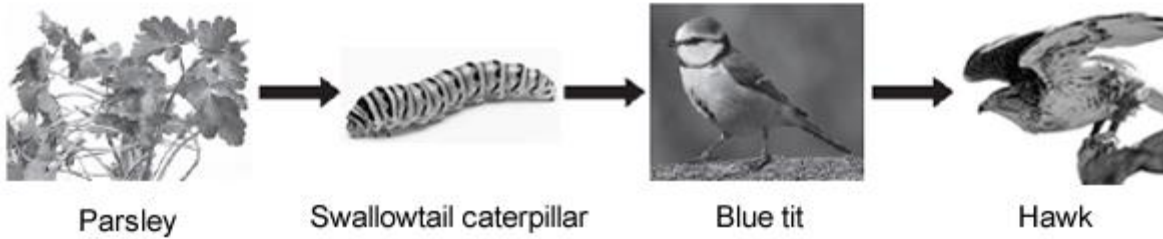
(1)

(Total 8 marks)

Q9.

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

Figure 1



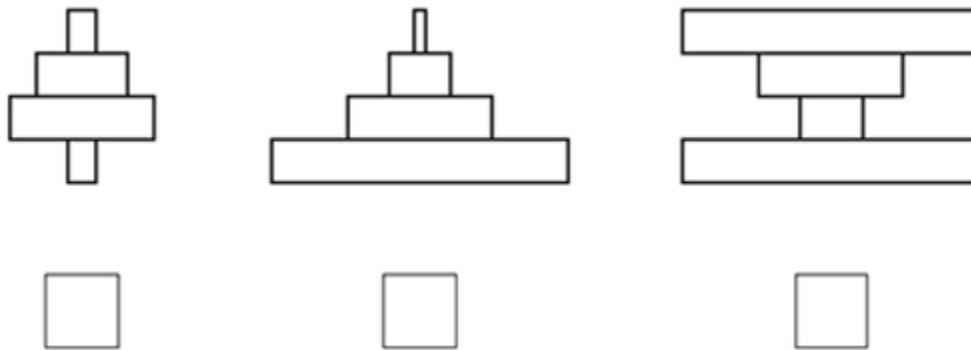
(a) The parsley shown in **Figure 1** carries out photosynthesis.

(2)

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

Why is photosynthesis important in the food chain?

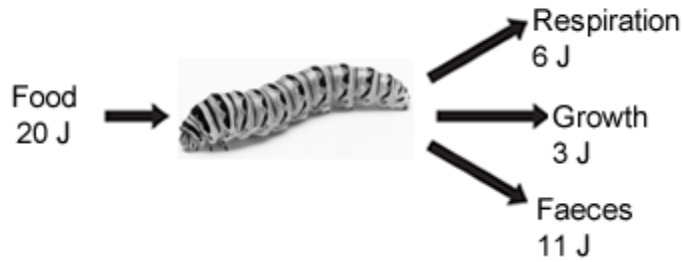
Tick (✓) **one** box.



(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?

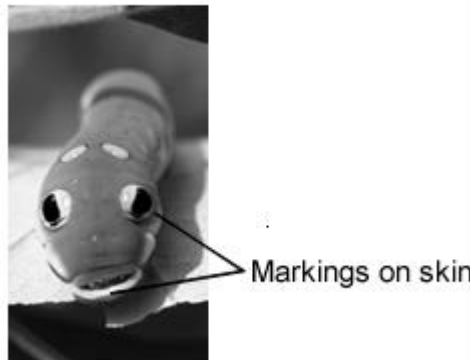
Percentage = _____

(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: © kojhirano/iStock
Swallowtail caterpillar: © Anna_Po/iStock

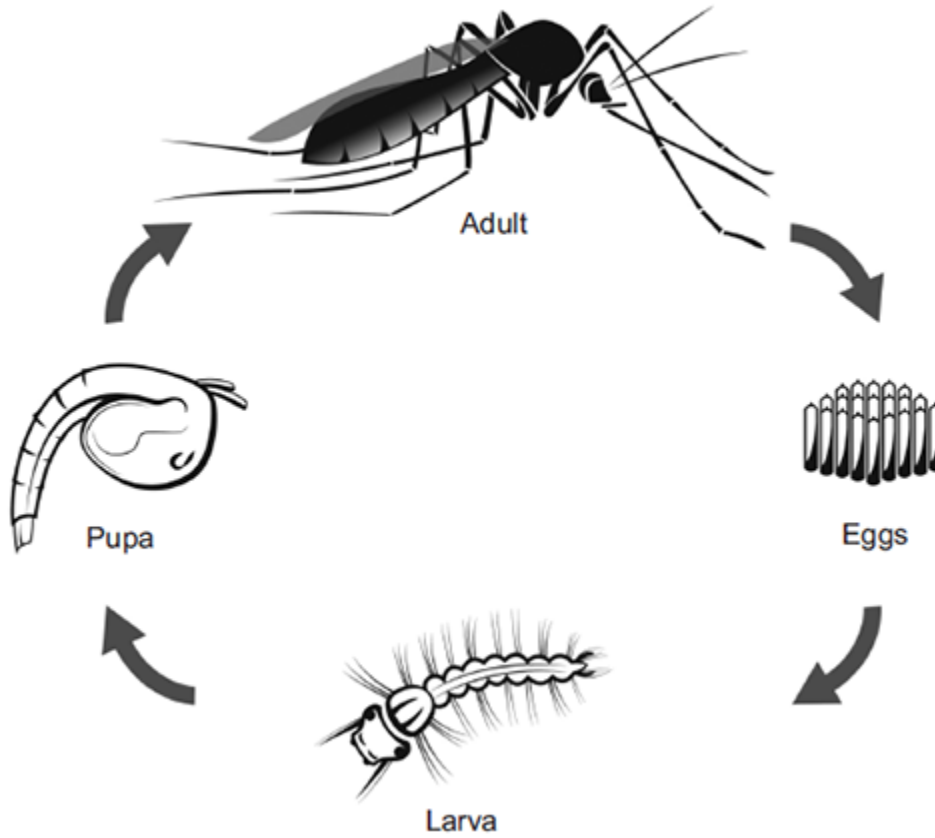
Q10.

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)

Q11.

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.

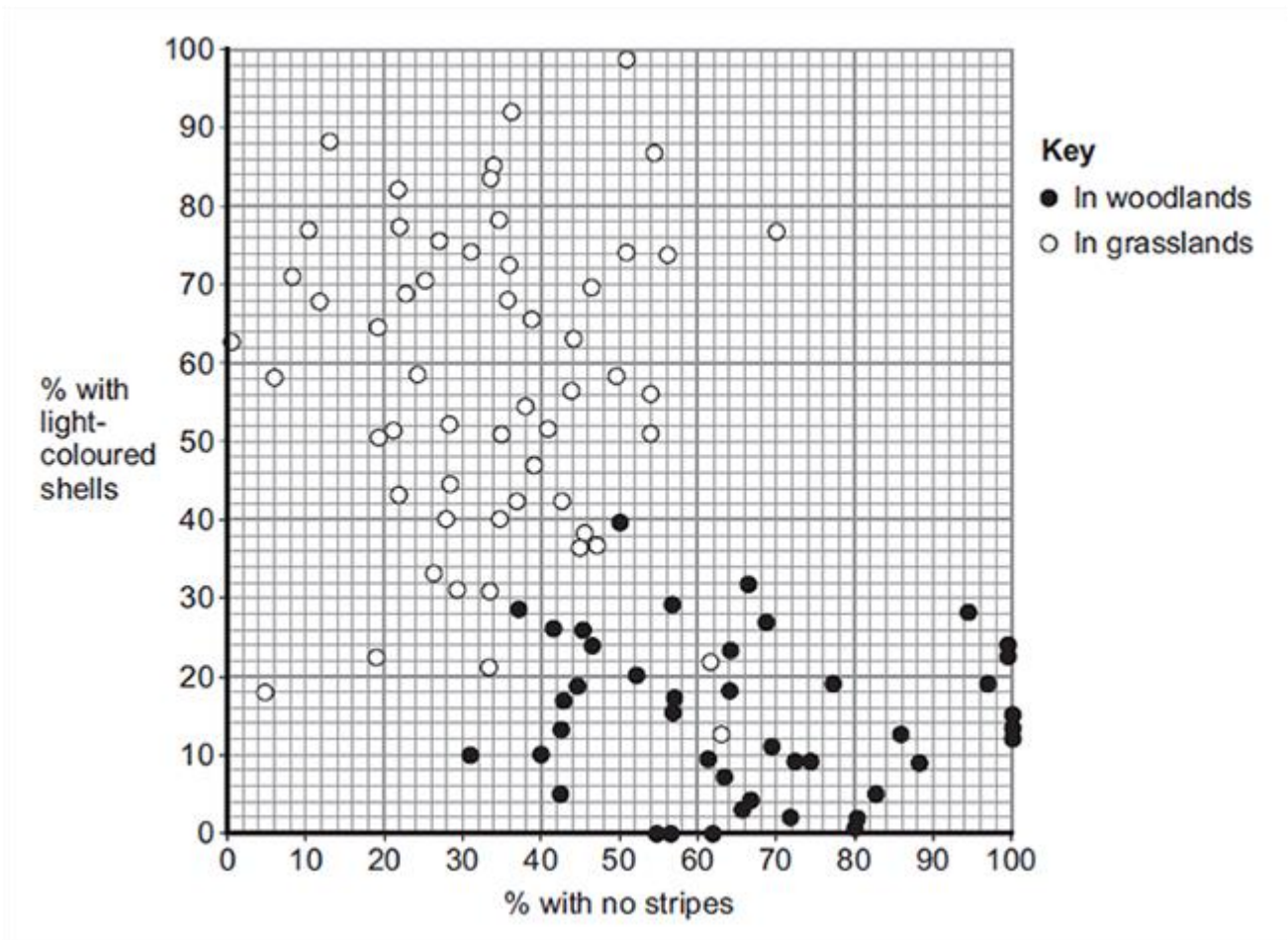
Figure 1



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)

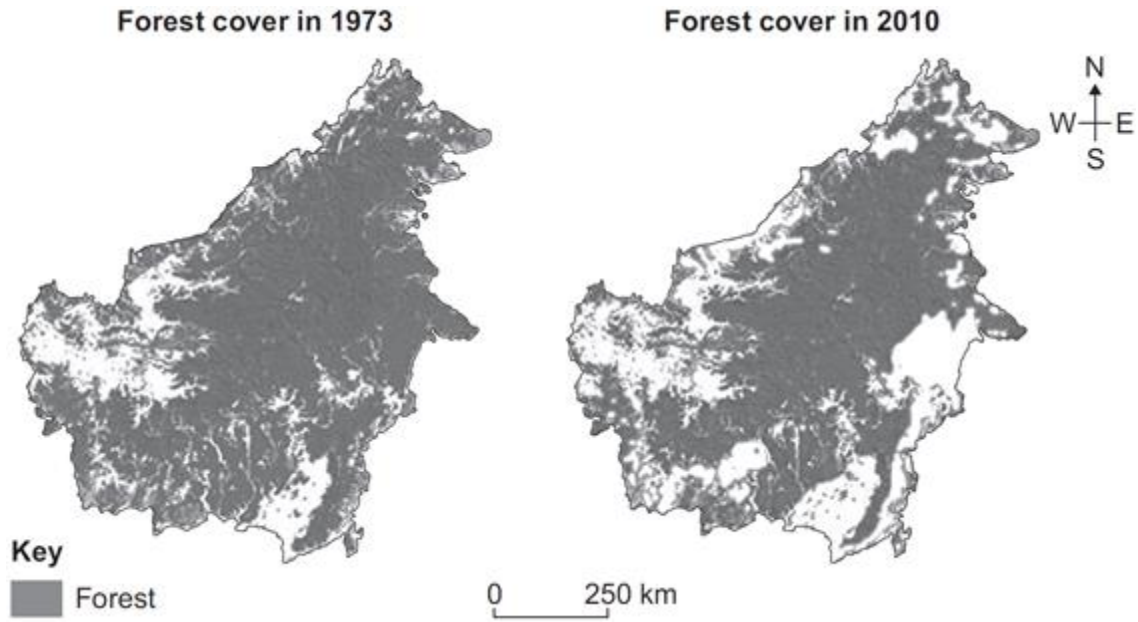
- (iii) Suggest a reason for the general appearance of snails that live in woodlands.

(1)

(Total 7 marks)

Q12.

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)

Q13.

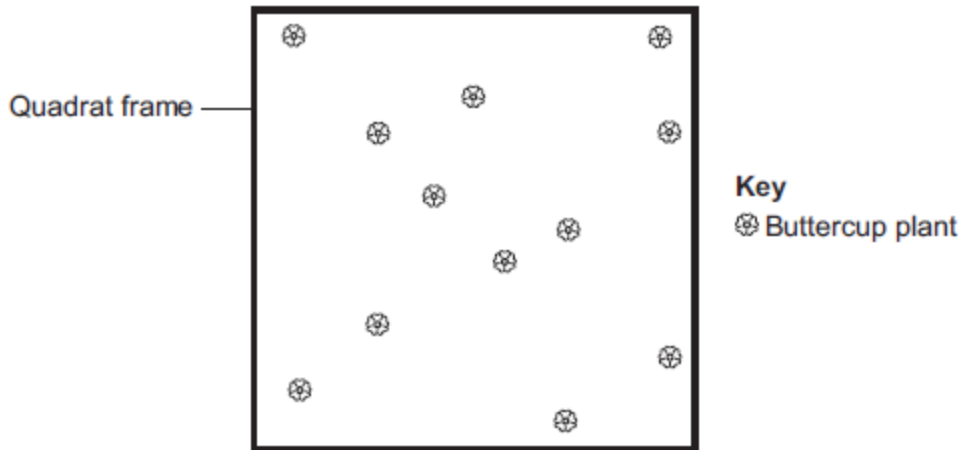
A grassy field on a farm measured 120 metres by 80 metres.

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.

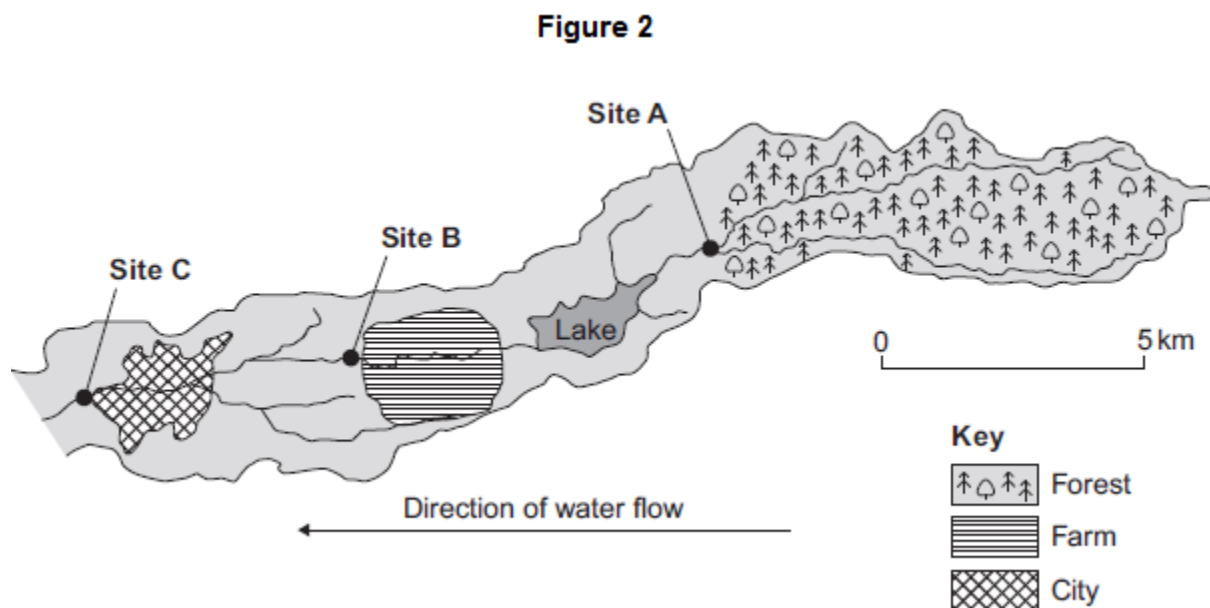
3.

(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.

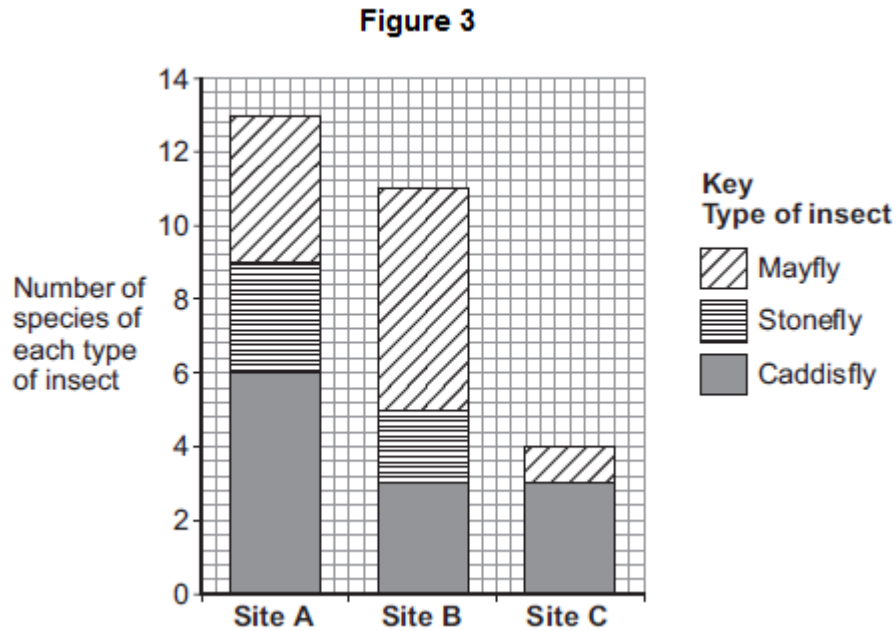


Every year, the farmer puts fertiliser containing mineral ions on some of his

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.



- (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)

Q14.

- (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 penguin



© pilipenkoD/iStock/Thinkstock

Chinstrap penguin

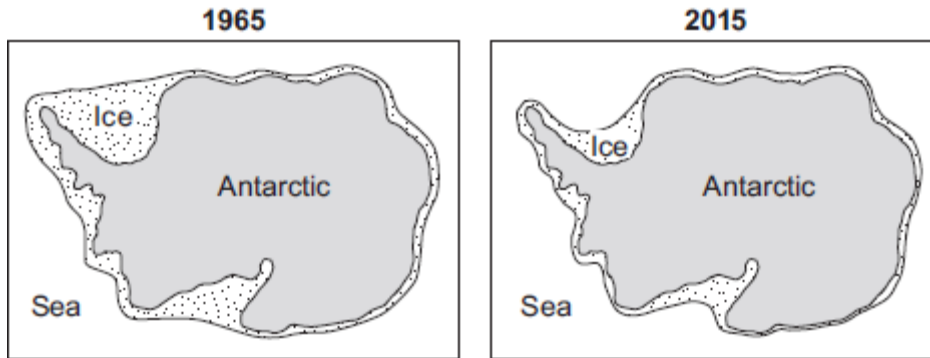


© Jenny Grayson/iStock/Thinkstock

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)

Q15.

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 m² areas of the lawn
- made solutions of the weed killer (each solution had a different concentration)
- put 5 dm³ of each solution on different 10 m² 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.

(Total 10 marks)

Q16.

Organisms compete with each other.

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

Figure 1

Saw wrack



© Nigel Downer/Science Photo Library

Bladder wrack



© Colin13362/iStock/Thinkstock

Bladders
filled with air

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

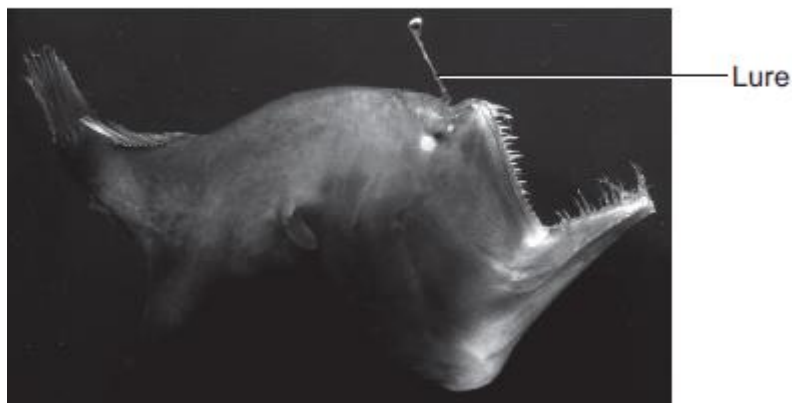
Bladder wrack has bladders filled with air.

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

(3)

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

Figure 2



© Dante Fenolio/Science Photo Library

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)

Q17.

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:

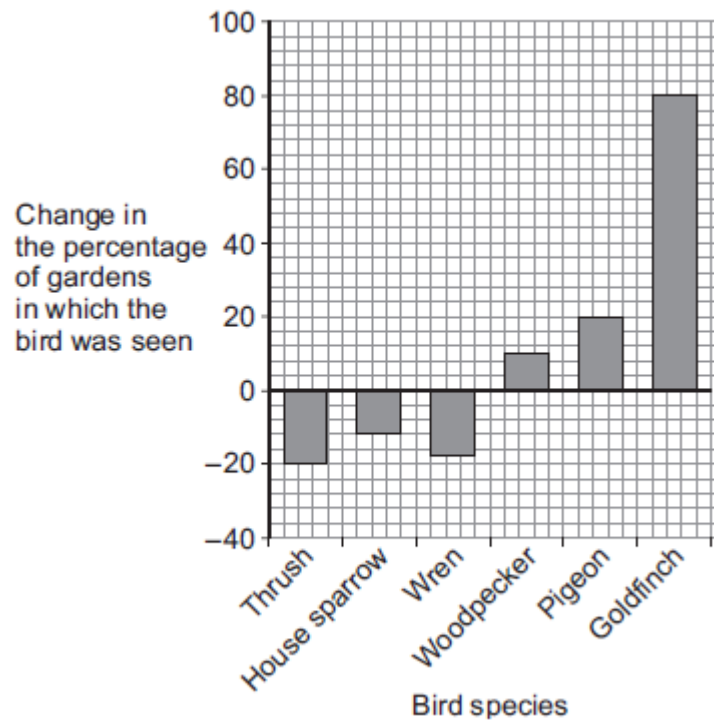
“In the UK, house sparrows are more common than blackbirds.”

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.

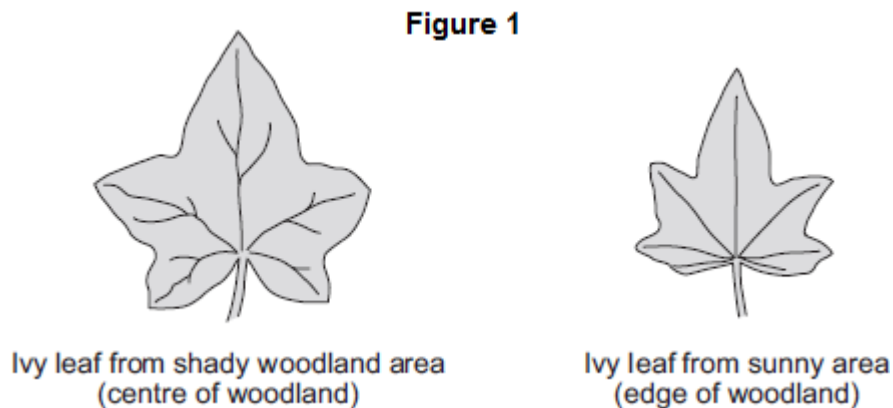
(2)
(Total 7 marks)

Q18.

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.

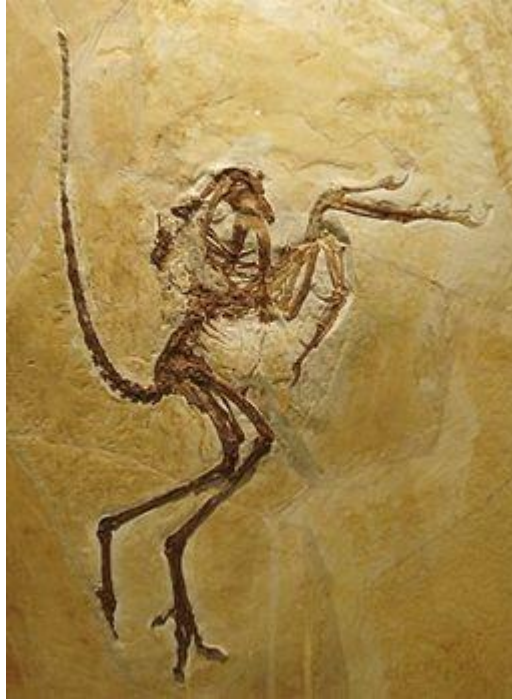


A student makes the following hypothesis.

“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.



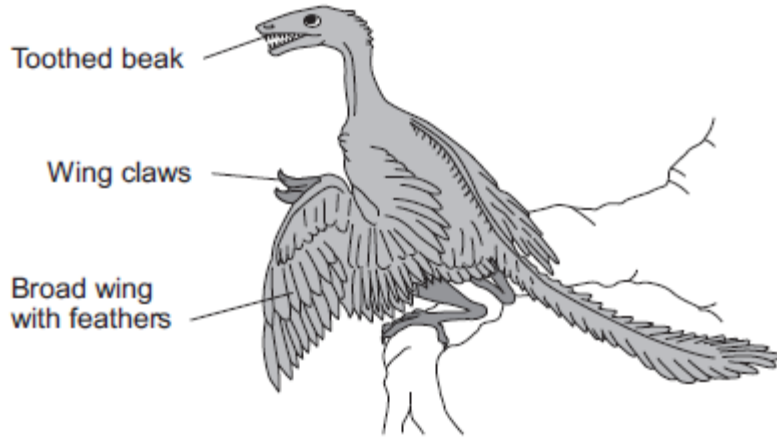
By Ghedoghedo (own work) [CC-BY-SA-3.0 (<http://creativecommons.org/licenses/by-sa/3.0/>) or GFDL (<http://www.gnu.org/copyleft/fdl.html>)], via Wikimedia Commons; By Steenbergs from Ripon, United Kingdom (Small Fishing Boat In North Sea) [CC-BY-2.0 (<http://creativecommons.org/licenses/by/2.0/>)], via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

Q20.

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**.

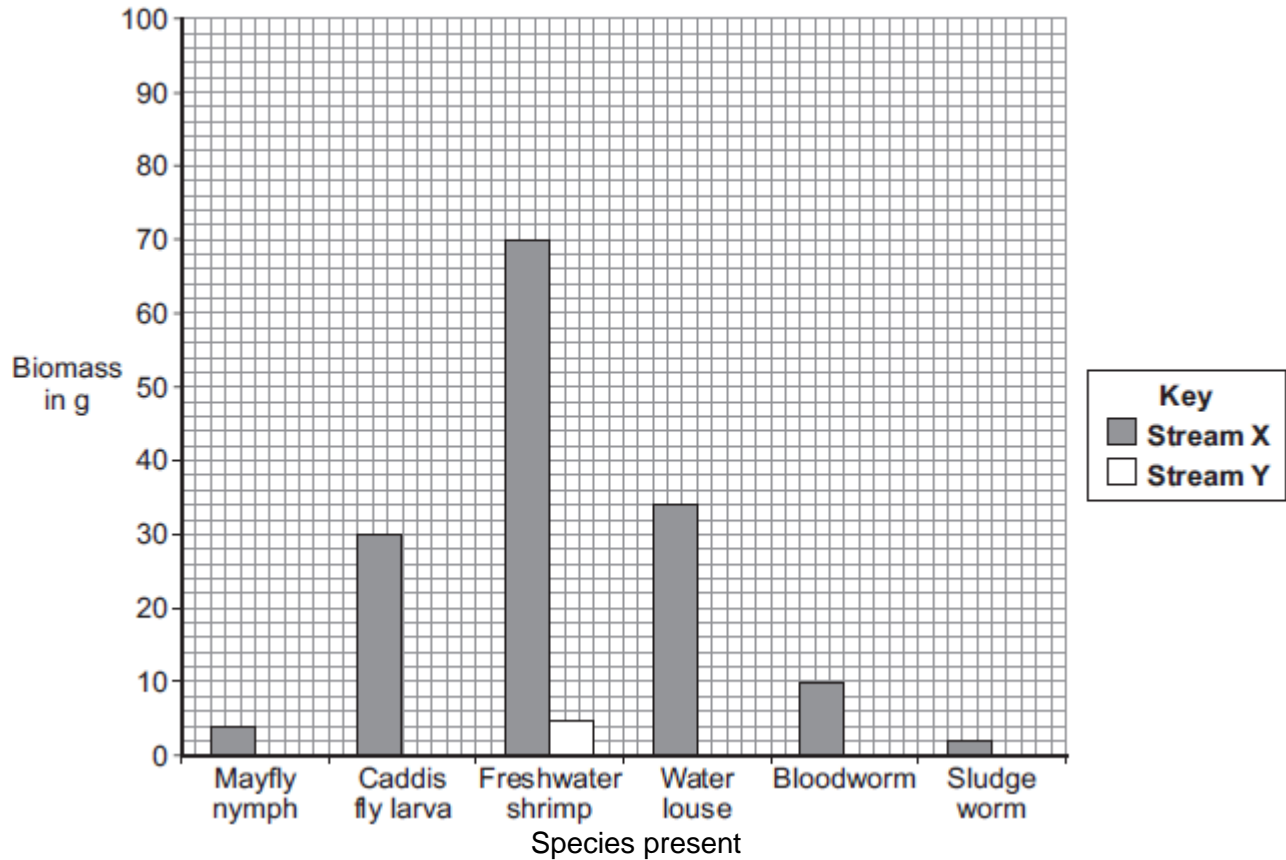
Table 1

Invertebrate species	Biomass in g	
	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

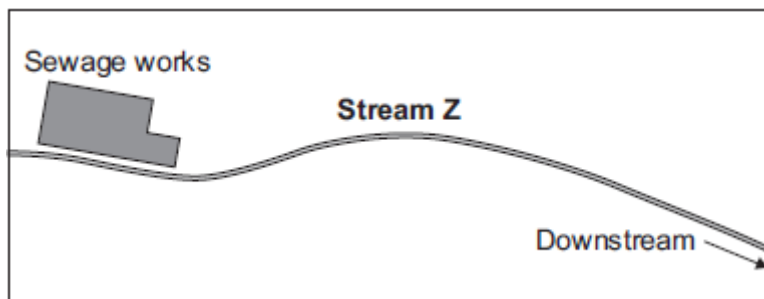
Pollution level	Invertebrate species likely to be present
Clean water	Mayfly nymph
Low pollution	Caddis fly larva, Freshwater shrimp
Medium pollution	Water louse, Bloodworm
High pollution	Sludge worm

Which stream, **X** or **Y**, is more polluted?

Use the information from **Table 1** and **Table 2** to justify your answer.

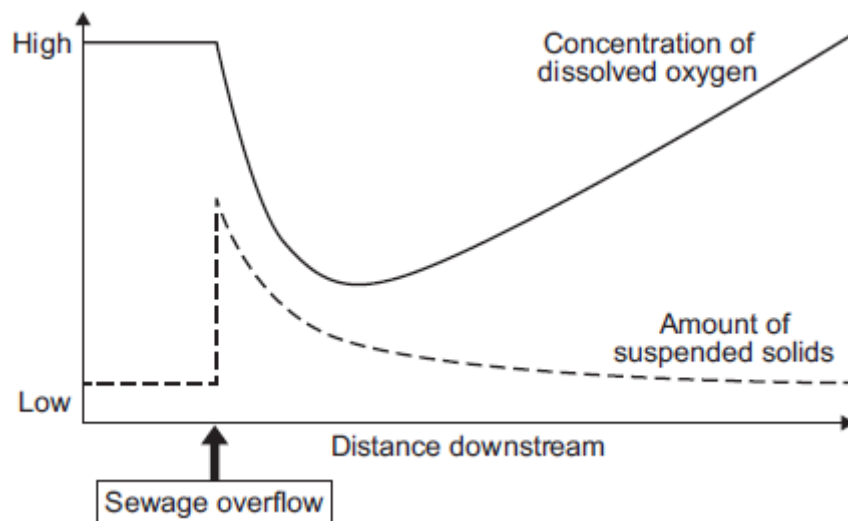
(2)

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

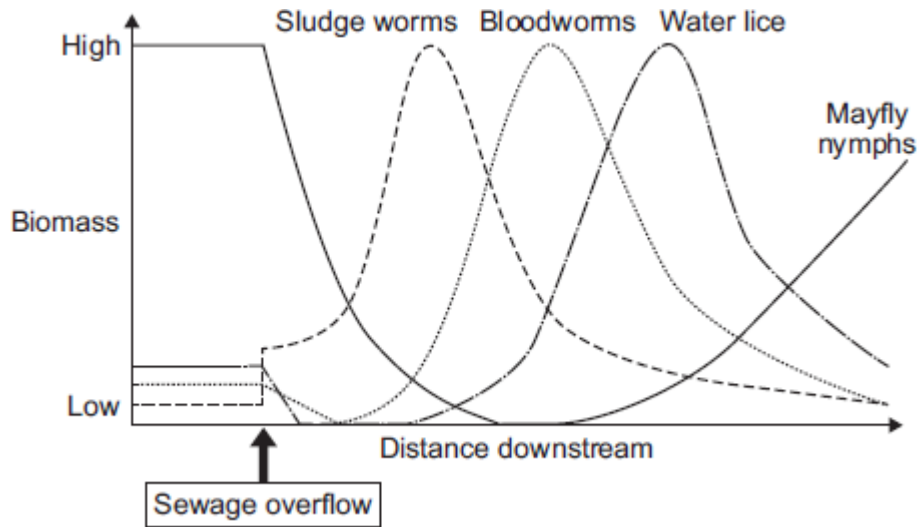


An accident caused sewage to overflow into **Stream Z**.
 Two weeks later scientists took samples of water and invertebrates from the stream.
 They took samples at different distances downstream from where the sewage overflowed.
 The scientists plotted the results shown in **Graphs P** and **Q**.

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.

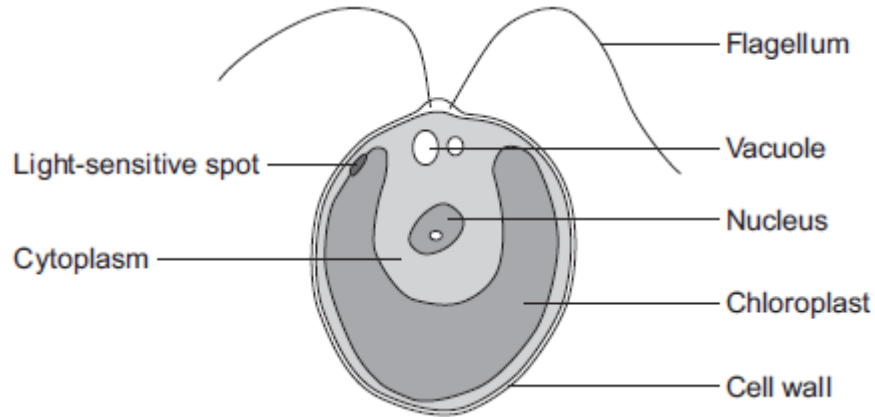
Explain why microorganisms cause the level of oxygen in the water to decrease.

(2)

(Total 13 marks)

Q21.

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?

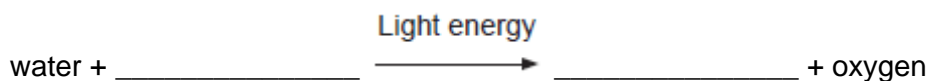
(1)

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

(1)

(c) (i) The alga can photosynthesise.

Complete the **word** equation for photosynthesis.



(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.

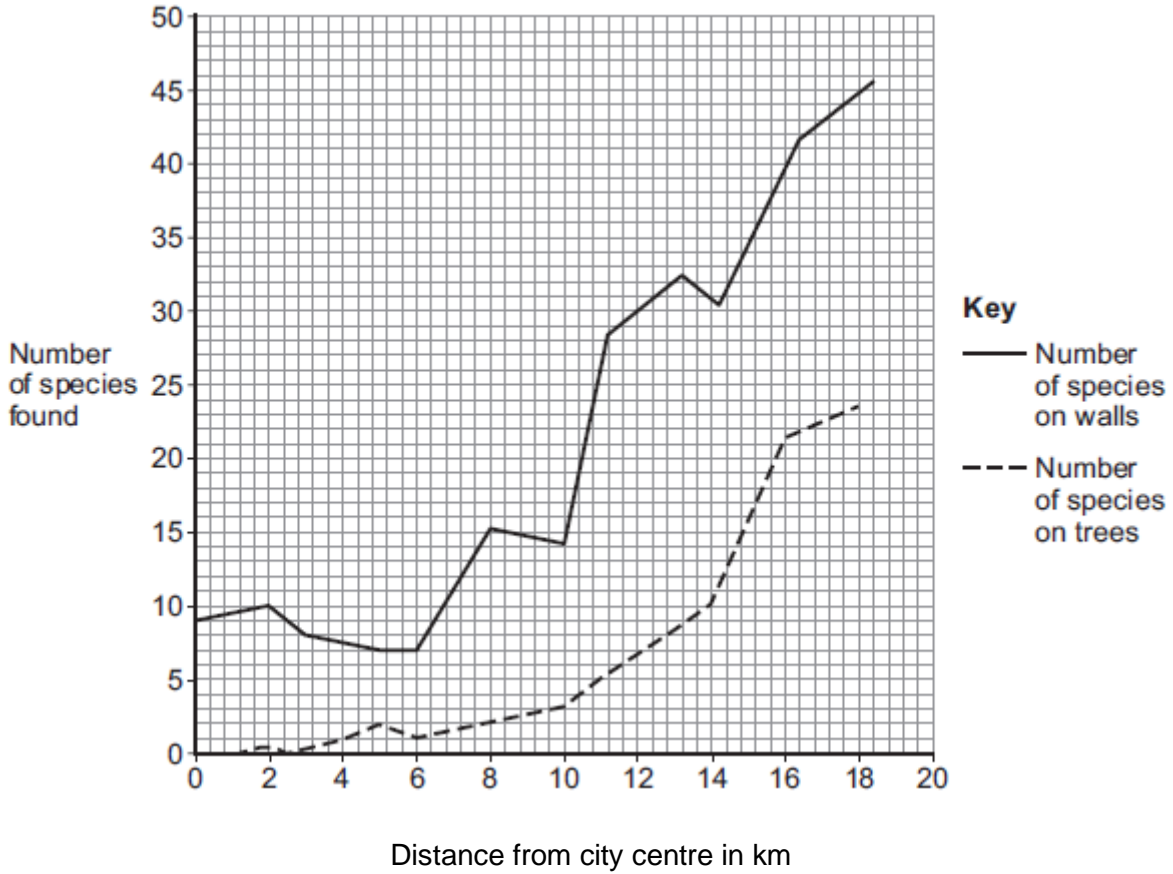
(3)

(Total 11 marks)

Q22.

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.

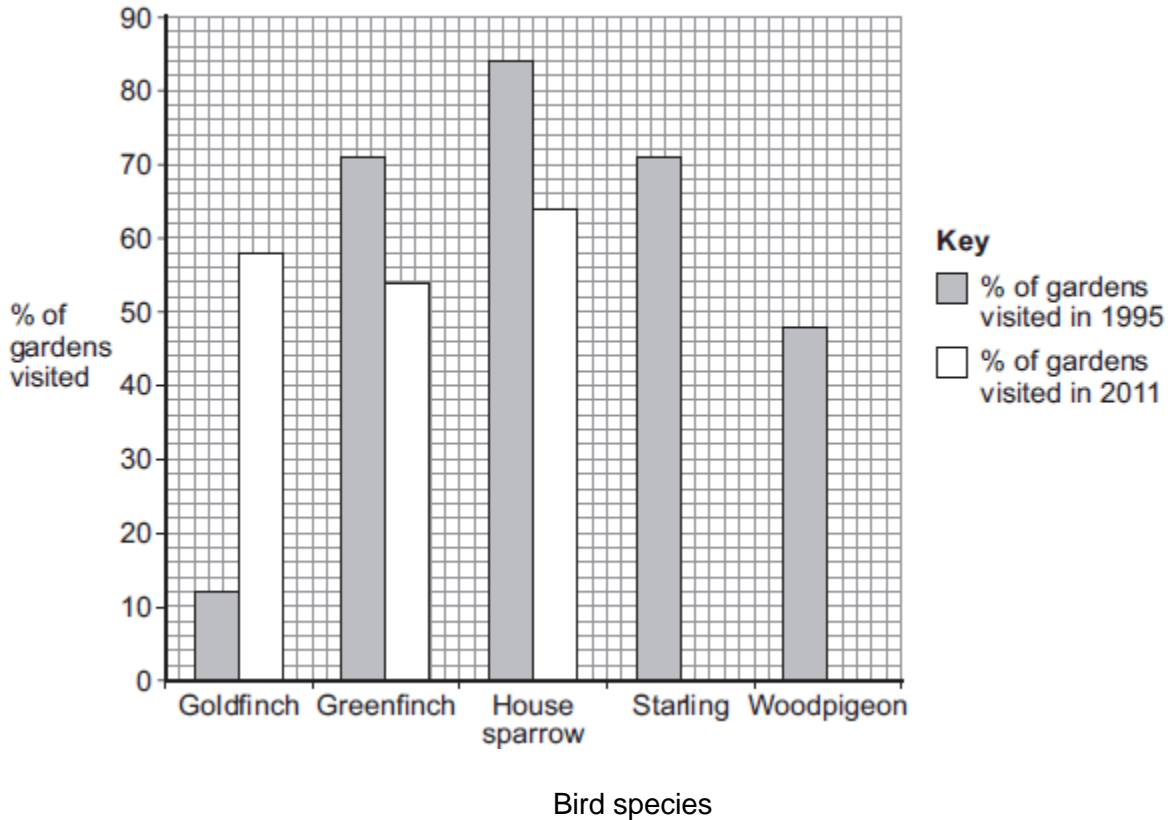
Some lichens grow very well in high levels of nitrogen oxides. They are

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)

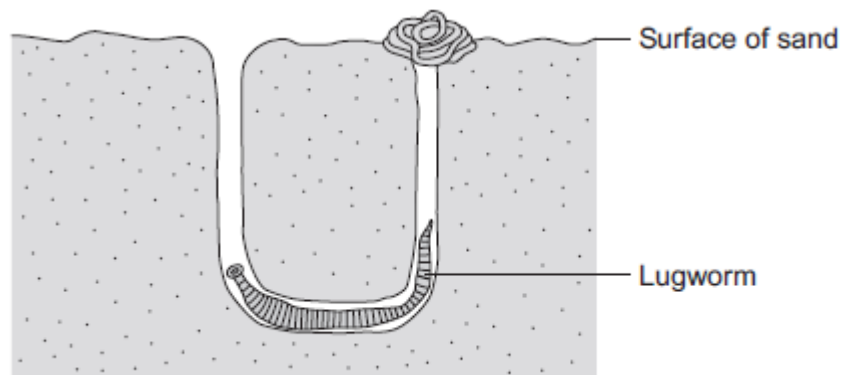
- (c) The change in the number of woodpigeons may be partly because they have spread to towns and cities.
Suggest why this increase in woodpigeons in towns and cities might have occurred.

(1)
(Total 7 marks)

Q24.

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)

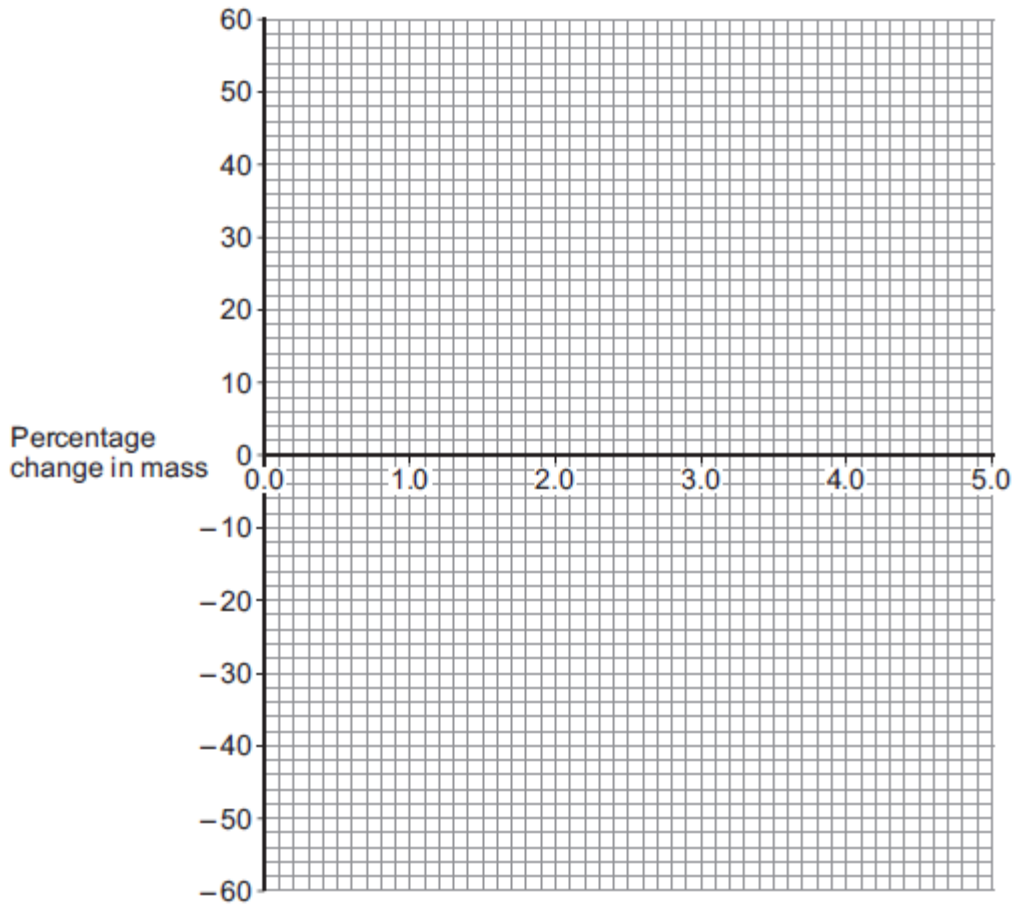
- (ii) Calculate the percentage change in mass for the 10 lugworms in the salt solution with a concentration of 2.0 arbitrary units.

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)

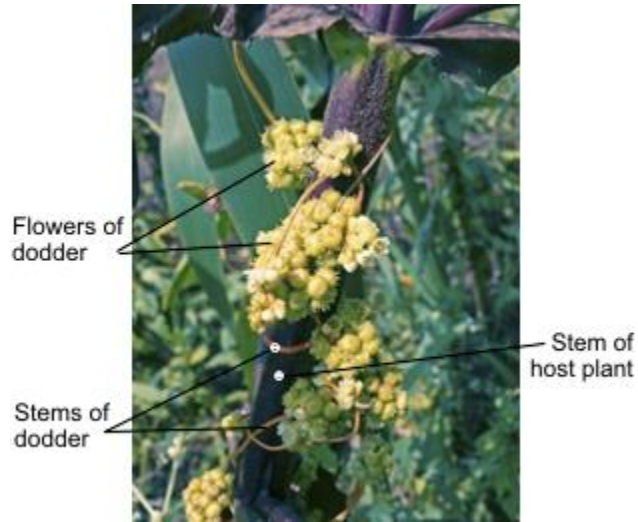
Q25.

- (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.



© yogesh_more/iStock/Thinkstock

- (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)

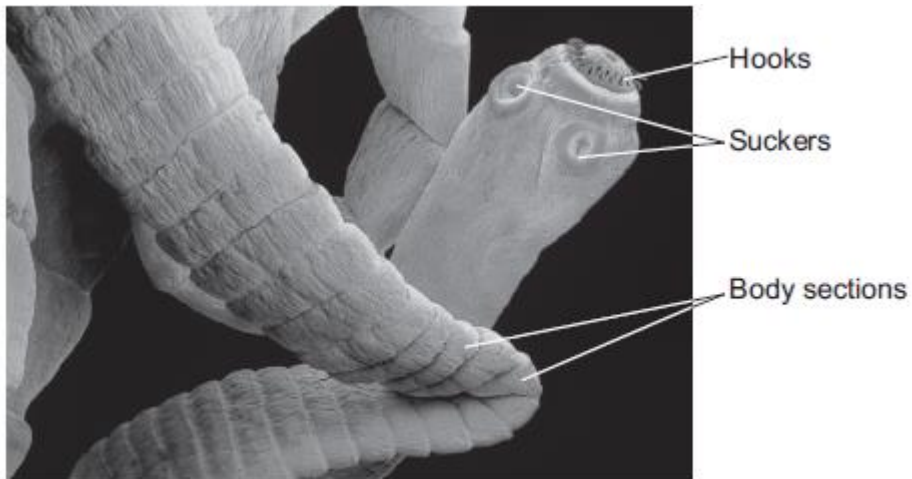
(iii) Suggest why the dodder will have a harmful effect on the host plant.

(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.



© Science Photo Library

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.

(Total 6 marks)

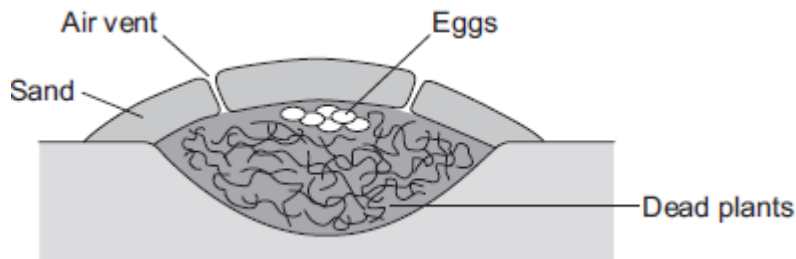
Q27.

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)

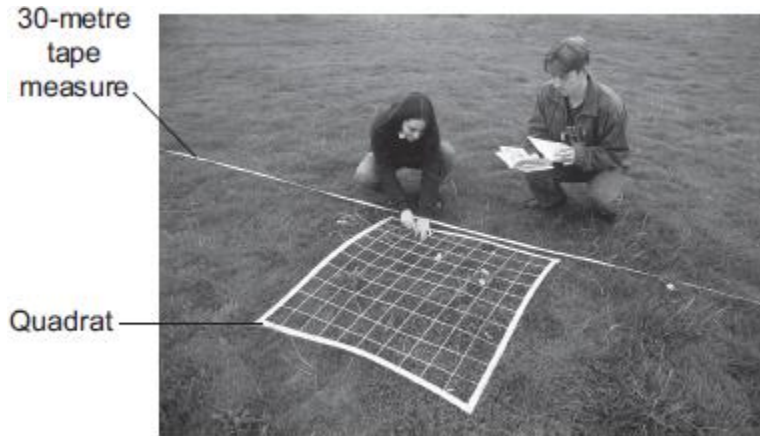
Q28.

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



© Science Photo Library

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

Figure 2

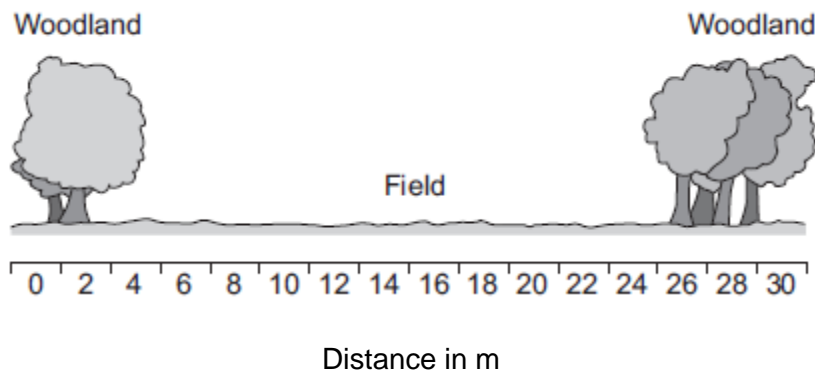
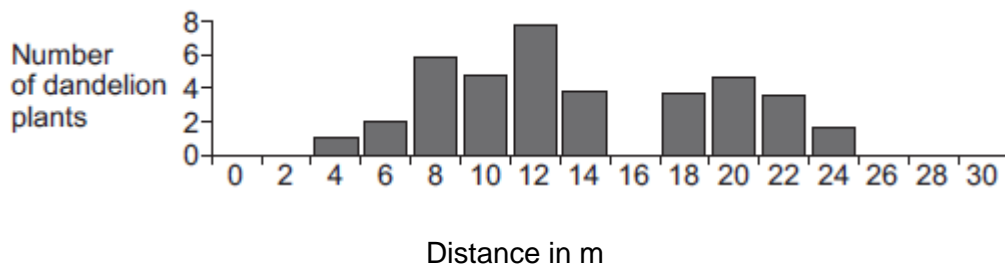


Figure 3



- (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.

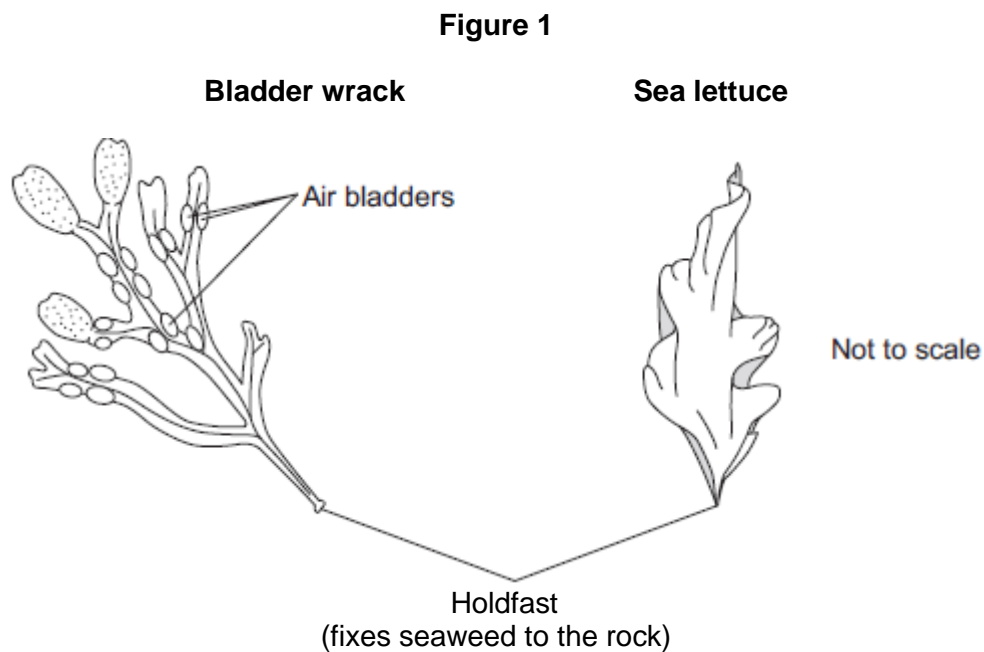
(2)
(Total 7 marks)

Q29.

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.



(a) The students:

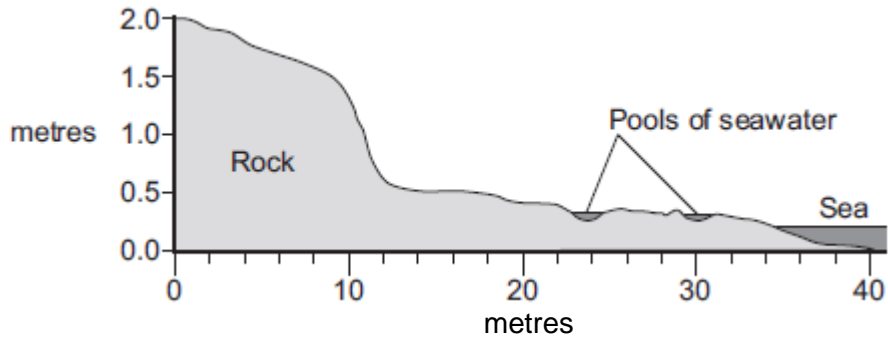
- 1 placed a 50-metre tape measure on the rocks at right angles to the sea
- 2 placed a quadrat next to the tape measure
- 3 recorded whether each species was present or not.

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

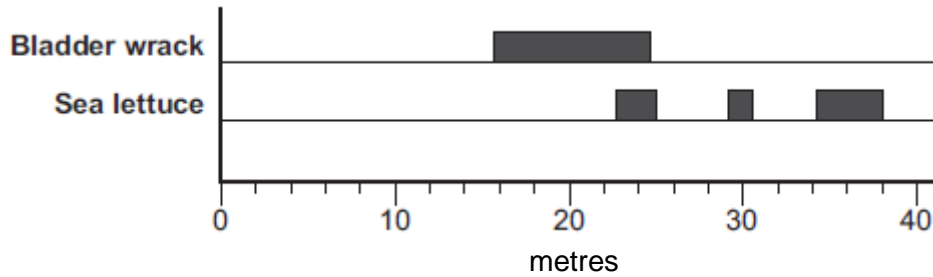
Figure 2 shows a section of the seashore and the students' results.

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)

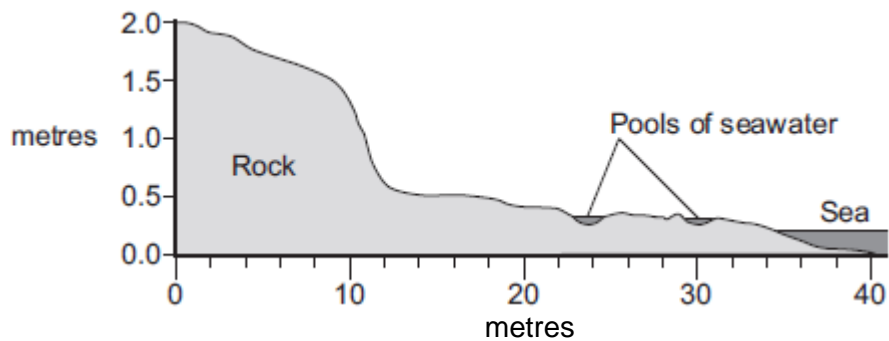
- (ii) How could the students have improved their investigation to ensure that they produced valid data?

(2)

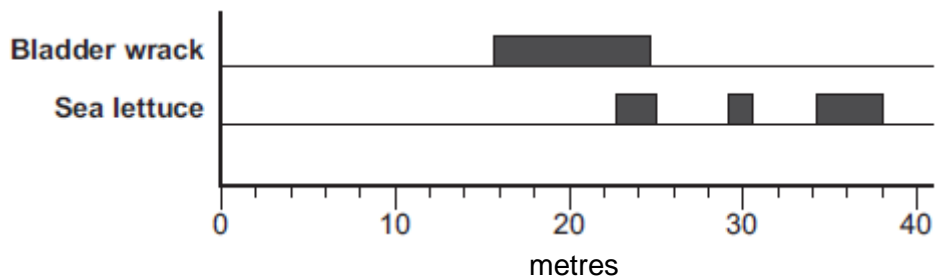
(iii) **Figure 2** is repeated here to help you answer this question.

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.

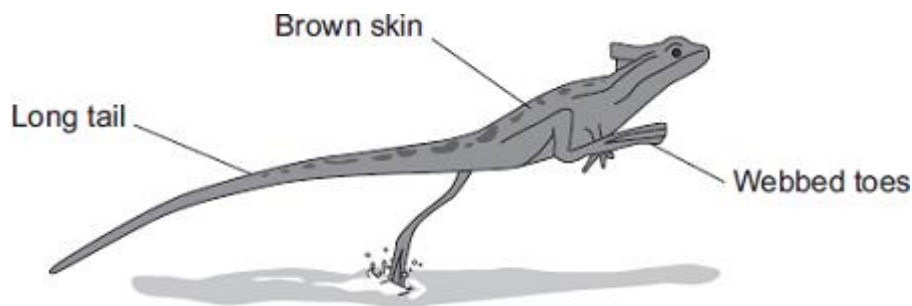
Suggest how this helps the bladder wrack to survive.

(2)

(Total 8 marks)

Q30.

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

Toes on the back feet are webbed

For camouflage on branches of trees

Long tail

Helps the lizard to balance when running

Brown skin

Warning colours to deter predators

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	<input type="checkbox"/>
Food	<input type="checkbox"/>

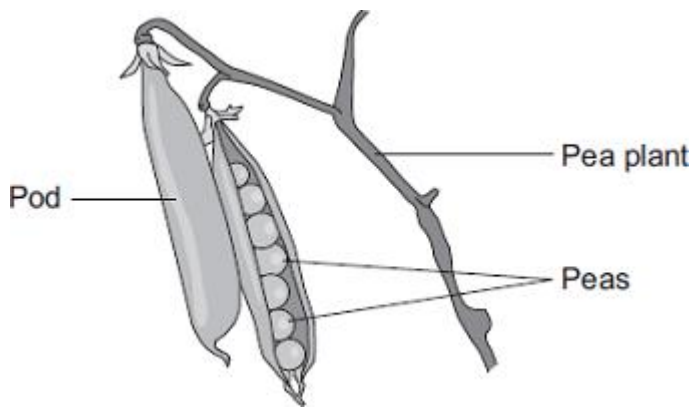
Territory

Light

(2)
(Total 6 marks)

Q31.

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)

Q32.

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)

Q33.

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)

Q34.

The photographs show four different species of bird.

Great tit



© JensGade/iStock

Coal tit

Blue tit



© Marcobarone/iStock

Long-tailed tit



© MikeLane45/iStock



© 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)

Q35.

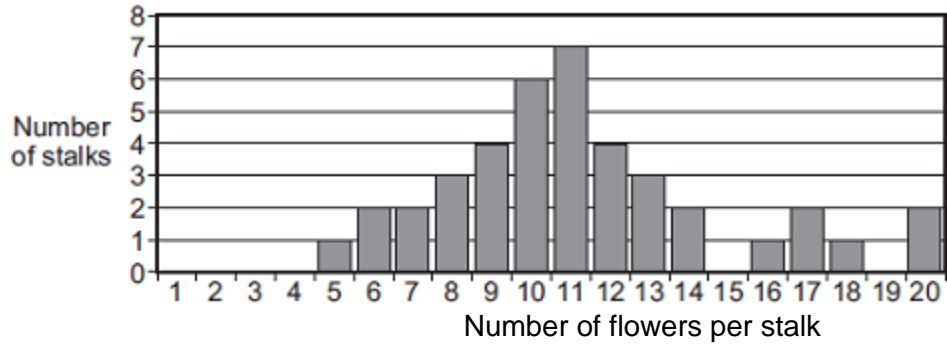
Some students studied bluebell plants growing in two different habitats.

Habitat **A** was a sunny field next to woodland.

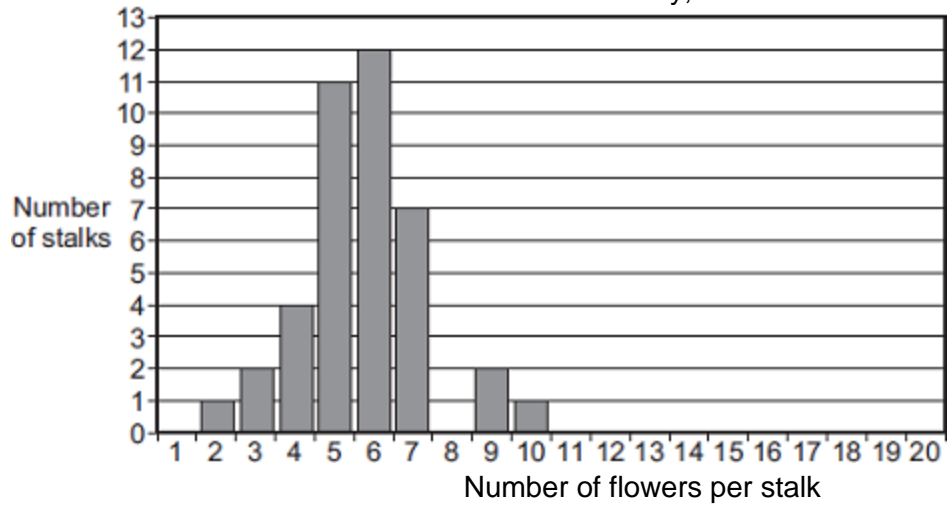
Habitat **B** was a shady, moist woodland.

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)

Mark schemes

Q1.

- (a) there is an uneven distribution of dandelions
or
 (more) representative / valid
or
 avoid bias
or
 more accurate / precise mean
ignore accurate / precise unqualified
ignore repeatability / reproducibility / reliability / fair test 1
- (b) (correct mean per m² ⇒) 6 or 6.0 1
- (correct field area ⇒) 55 000 (m²) 1
- mean × area – e.g. 6(.0) × 55 000
allow incorrect calculated values for mean and / or field area 1
- 330 000
allow correct calculation from previous calculation 1
- 3.3×10^5
allow calculated value in standard form 1
an answer of 3.3×10^5 scores 5 marks
an answer of 330 000 scores 4 marks
- (c) **Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced. 5–6
- Level 2:** The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced. 3–4
- Level 1:** The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear. 1–2
- No relevant content** 0
- Indicative content**
- placing of quadrat

- large number of quadrats used
- how randomness achieved – e.g. table of random numbers **or** random number button on calculator **or** along transect
- quadrats placed at coordinates **or** regular intervals along transect
- in each of two areas of different light intensities **or** transect running through areas of different light intensity
- for each quadrat count number of dandelions
- for each quadrat measure light intensity
- compare data from different light intensity

to access **level 3** the key ideas of using a large number of quadrats randomly, or along a transect, and counting the number of dandelions in areas of differing light intensity need to be given to produce a valid outcome

(d) any **two** from:

- temperature
allow heat
- water
allow moisture / rain
- (soil) pH
allow acidity
- minerals / ions
allow e.g. magnesium ions or nitrate
allow salts / nutrients
- winds
- herbivores
allow trampling
ignore carbon dioxide
ignore space
ignore competition unqualified
*do **not** accept oxygen*

2

[14]

Q2.

(a)

	statement is true for		
	mitosis only	meiosis only	both mitosis and meiosis
all cells produced are genetically identical	✓		
in humans, at the end of cell division each cell contains		✓	

23 chromosomes			
involves DNA replication			✓

3 correct = 2 marks
 2 correct = 1 mark
 0 or 1 correct = 0 marks

2

(b) any **two** from:

ignore references to one parent only

- many offspring produced
- takes less time
allow asexual is faster
- (more) energy efficient
- genetically identical offspring
allow offspring are clones
- successful traits propagated / maintained / passed on (due to offspring being genetically identical)
- no transfer of gametes or seed dispersal
allow no vulnerable embryo stage
allow no need for animals
- not wasteful of flowers / pollen / seeds
- colonisation of local area
must imply local area

2

(c) genetic variation (in offspring)

1

(so) better adapted survive

allow reference to natural selection or survival of the fittest

1

(and) colonise new areas by seed dispersal

or

can escape adverse event in original area (by living in new area)

must imply new area

1

many offspring **so** higher probability some will survive

1

allow bluebell example described (max 3 if not bluebell)

[8]

Q3.

(a)

Classification group	Name
Class	<i>Mammalia</i>
Order	<i>Primates</i>
Family	<i>Lemuroidea</i>
Species	<i>catta</i>

all 4 correct = 2 marks
2 or 3 correct = 1 mark
0 or 1 correct = 0 marks

2

(b) Lemur catta

ignore capitalisation / non-capitalisation of initial letters

ignore italics / non-italics

ignore underlining / non-underlining

1

(c) carried by (favourable) currents on masses of vegetation

allow description of currents from Figure 2

ignore swimming

1

(d) isolation of different populations

1

habitat variation between lemur populations

allow examples – biotic (e.g. food / predators) or abiotic (e.g. temperature)

1

genetic variation or mutation (in each population)

1

better adapted survive (reproduce) **and** pass on (favourable) allele(s) to offspring

*allow natural selection **or** survival of the fittest **and** pass on (favourable) allele(s) to offspring*
allow gene(s) / mutation as an alternative to allele(s)

1

(eventually) cannot produce fertile offspring with other populations

allow cannot reproduce 'successfully' with other populations

ignore cannot reproduce unqualified

1

[9]

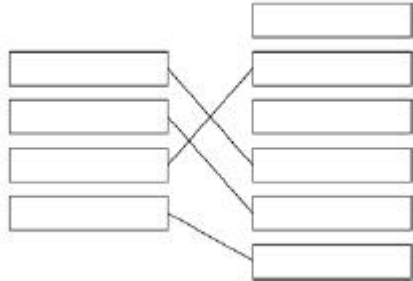
Q4.

(a) Carl Linnaeus

(b) Lithops 1

extras cancel
ignore capitalisation / non-capitalisation

1



(c)

1 mark per line
extra line from adaptation negates the mark for that adaptation

1
1
1
1

(d) any **two** from:

- cooler underground / at night
or
the jerboa can keep cool
- loses less water
or
sweats less
- less likely to be seen (by predators / prey)

2

(e) behavioural

1

[9]

Q5.

(a) correct figures from graph: 5.0 / 5 and 2.60 / 2.6

2.40 / 2.4

an answer of 2.40 / 2.4 scores 2 marks

1

allow correct answer from candidate's figures from graph for 1 mark

1

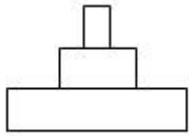
(b) $\frac{1}{3}$

1

(c) protein

1

- (d) a genetically-modified variety of seed was sown in 2004 1
- more rain fell in spring and early summer in 2004 1
- the mean summer temperature was lower in 2003 1



- (e) 1
- (f) 80 1
- (g) chickens use energy for movement and for keeping warm 1
- much of the food eaten by chickens is wasted as faeces 1

[11]

Q6.

- (a) large number – more representative and so more valid (mean can be calculated) 1
allow more reliable
- random – avoid bias 1
- (b) correct figures in table: 1
 (3)
 (8)
 (16)
 19
 9
 4
 1
- (c) all bars plotted correctly 1
± 1 mm
allow ecf from the table
- (d) any **three** from: 1
- much overlap of values between the 2 shores
- sheltered shore:**
accept converse for exposed shore

- wider range **or** use of figures – e.g. approx 0.26 to 0.70 cf 0.21 to 0.55
 - higher mode **or** use of figures – e.g. 0.41 to 0.45 cf 0.36 to 0.40
allow ecf for figures from (b)
 - there are no limpets at 0.21 to 0.25
allow there are no limpets on exposed shore at 0.56 to 0.70
- 3
- (e) sheltered – 0.47 **or** 0.466
- 1
- exposed – 0.35 **or** 0.354
- 1
- (f) radius = 2.48cm
- 1
- an answer of 38.6 / 38.62 / 38.64 scores 3 marks*
- 1
- (area = $3.14 \times (2.48)^2 =$) 19.3cm²
- allow area calculated from incorrect radius*
- 1
- (force = $19.3 \times 2 =$) 38.6 (newtons)
- or**
- (force = $[3.14 \times (2.48)^2] \times 2$)
- = 38.62 (newtons)
- or**
- (force = $[\pi \times (2.48)^2] \times 2$)
- = 38.64 (newtons)
- allow force calculated from 1 previous error*
- 1
- (g) any **two** from:
- foot may not be circular
 - foot may be larger / smaller than outside of shell
 - scientists' value is approximate
 - variation between limpets / described
*e.g. re muscle development **or** greater 'awareness' of some limpets*
 - variation in rock surface texture
- 2
- (h) any **three** from:
- more force of waves to dislodge limpets
 - lower height lowers exposure to waves
 - wider foot gives greater grip
 - those with this / these feature(s) pass on alleles / genes to offspring leading to population of broad squat limpets
allow converse for sheltered shore throughout, if clearly stated
- 3

[17]

Q7.

- (a) less sweating so less water loss

	1
(as) no / little water available in desert	1
(b) (fat store) can be metabolised / respired to water	1
(little urine...) conserve water	1
(hard mouth) not damaged by spines on plants / on food or not damaged by hard / dry food	1
(c) dromedary / <i>C.dromedarius</i> and bactrian / <i>C. bactrianus</i> <i>no mark for the names, but must be identified</i> because same genus <i>ignore 'both are Camelus'</i>	1
(d) any two from:	
• the fossil record	
• oldest fossils in N. America or	
• newer fossils in S. America / in Asia / in Africa <i>allow numbers for ages (45 Mya and 3 Mya / 6 Mya)</i>	
• chemical / DNA analysis of living species <i>allow radioactive dating of fossils</i>	2
(e) isolation of separate camel populations by sea or by mountains	1
habitat variation / described between populations <i>allow examples – biotic (e.g. food / predators) or abiotic</i>	1
genetic variation / mutation in each population	1
45 million years is sufficient time to accumulate enough mutations	1
natural selection or better adapted survive to reproduce	1
pass on favourable allele(s) <i>allow gene(s)</i>	1

Q8.

- (a) snail
or
shrew

additional incorrect answer negates correct answer

1

- (b) shrew

additional incorrect answer negates correct answer

1

- (c) fewer shrews to eat them

1

- (d) population

1

- (e) **C**

1

- (f) $(11\ 000 \times 0.1 =)$
1 100 (kJ)

1

- (g) the snails do not eat the roots of the lettuces

1

- (h) any **one** from:
- light (intensity)
 - temperature
 - moisture (levels)
 - soil pH
 - mineral / ion content (of soil)
 - wind intensity / speed
ignore wind direction
 - carbon dioxide (levels)
 - oxygen (levels)

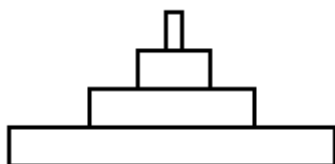
1

[8]

Q9.

- (a) any **two** from:
- *idea of* absorption of light / energy
 - transfer to chemical energy
allow produce sugars / glucose / starch / carbohydrate / food / biomass
 - provides food / energy for animals / caterpillar
 - releases oxygen

2



(b) 1

(c) 15% 2

$\frac{3 \times 100}{20}$
 allow 1 mark for $\frac{3 \times 100}{20}$ with no answer or incorrect answer
or
 allow 1 mark for 0.15

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

- markings look like eyes / face / mouth of much larger animal
- looks fierce / scary / dangerous
allow it looks like a snake
- to frighten blue tit / bird

max 1 if reference to camouflage 2

(ii) any **two** from:

- sharp / long / big claws
ignore strong
- sharp / hooked beak
ignore strong / big
- large wings **or** flies quickly
allow streamlined / aerodynamic
ignore powerful wings
- good eyesight

2

[9]

Q10.

(a) 0.67%

allow $0.\dot{6}$ or 0.7
 allow 1 mark for evidence of $(2 \times 10^6) \div (3 \times 10^8)$
or
 allow 1 mark for 0.0067 or 0.6 2

(b) (i) idea that food chains start with plants / producers
allow food chains do not start with animals or larvae are consumers 1

idea that these make food (for other organisms in the chain)
allow idea that plants / producers photosynthesise or plants / producers get energy from the sun
allow mosquito larvae do not make food / photosynthesise or

mosquito larvae do not get energy from the sun

1

- (ii) any **four** from:
- reasoned argument for **or** against release
must refer to at least one advantage and one disadvantage.
*max 3 marks for either only advantages **or** only disadvantages*

advantages:

- fewer mosquitos biting **or** spreading malaria
- fewer people get / die from malaria
allow people won't get / die from malaria
- lower medical costs (for those infected **or** for treatment) **or** less healthcare needed
- better economically for developing / tropical countries.

disadvantages:

- fewer crops reproduce
allow fewer crops pollinated
- poorer crop yield
- possible starvation (of people)
- high cost of GM production / mosquito release
- less food for bats / birds **or** bats / birds die
*allow disruption to food chain / ecosystem **or** reduction of biodiversity*
- gene could 'escape' into other wildlife / species
ignore into plants

4

- (iii) any **three** from:
- gene from bacteria cut out
allow allele for gene
 - ref to enzymes (anywhere in process)
allow at any point in process, ie in cutting or in splicing
 - (gene) transferred to chromosome of mosquito
allow DNA for chromosome
 - at an early stage of development
allow egg / embryo

3

[11]

Q11.

- (a) (i) any **two** from:
- not all eaten
allow eaten by other animals
 - used for respiration
ignore used / lost in heat / movement
 - lost as CO₂ / water / urea
 - lost as faeces **or** not all digested
if neither mark awarded allow 1 mark for lost as waste
- ignore references to energy losses*

do not allow for growth / repair / reproduction

2

- (ii) any **one** from:
- thrushes eat other things
 - thrush numbers likely to vary (considerably)
allow it is only an estimate (of population size) or only counted thrushes for 5 hours
 - thrushes were not present all the time
 - thrushes feed on a much bigger area

1

- (b) (i) any **one** from:
- there are two dependent variables
 - there is no independent variable
 - to show the association / correlation / pattern (between the two variables)

1

- (ii) (snails in woodlands)
more have dark(er) colour(ed shells) **or** fewer have light-coloured shells
allow converse for grassland, if clear

1

(shells have) no / fewer stripes or have no stripes
allow converse for grassland, if clear

1

- (iii) less likely to be seen (by predators / birds / thrushes)
allow camouflaged (from predators / birds / thrushes)
allow light coloured shells with stripes would be more visible (to predators / birds / thrushes in woodland (than grassland)).

1

[7]

Q12.

- (a) (i) forest at the edges (of the island) has been removed
allow centrally the forest remains

1

an appropriate area on the island is identified eg south east **or** bottom right

1

- (ii) any **two** from:
- (to provide land) for farming / agriculture
 - (to provide land) for quarrying
 - (to provide land / wood) for building
allow to provide timber
 - to provide fuel
 - to produce paper
allow forest fires

2

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

- decreased biodiversity
- loss of habitats
- increased carbon dioxide (concentration)
- global warming
allow effects of global warming eg flooding / rise in sea level
allow soil erosion

2

[6]

Q13.

- (a) (i) counts / 12

1

$\times 120 \times 80 / \times 9600$

or

\times area of field

1

- (ii) (more) quadrats / repeats

1

placed randomly

ignore method of achieving randomness

1

- (b) (i) any **three** from:

- temperature / warmth / heat
- water / rain
- minerals / ions / salts (in soil)
allow nutrients / fertiliser / soil fertility
ignore food
- pH (of soil)
- trampling
- herbivores
ignore predators
- competition (with other species)
- pollution qualified e.g. SO₂ / herbicide
- wind (related to seed dispersal).
ignore space / oxygen / CO₂ / soil unqualified

3

- (ii) light needed for photosynthesis

1

for making food / sugar / etc.

1

effect on buttercup distribution eg more plants in sunny areas / fewer plants in shady areas

1

- (c) (i) fertiliser / ions / salts cause growth of algae / plants

1

(algae / plants) block light

- 1
- (low light) causes algae / plants to die
- 1
- microorganisms / bacteria feed on / break down / cause decay of organic matter / of dead plants
do **not** allow germs / viruses
- 1
- (aerobic) respiration (by microbes) uses O₂
do **not** allow anaerobic
- 1
- (ii) sewage / toxic chemicals / correct named example eg metals / bleach / disinfectant / detergent etc
allow suitable named examples eg metals such as Pb / Zn / Cr / oil / SO₂ / acid rain / pesticides / litter
ignore chemicals unqualified
ignore waste unqualified
ignore human waste / domestic waste / industrial waste unqualified
- 1
- (d) (i) 2
- 1
- (ii) more food
allow other sensible suggestion eg more species colonise from tributary streams after forest
- 1
- (iii) number of stonefly species decreases (from **A** to **B** / **B** to **C** / **A** to **C**) as more pollution enters river / less oxygen
allow fewer species in more polluted water
ignore none are found at site C
- 1

[19]

Q14.

- (a) an extremophile species
- 1
- (b) (i) smaller ice area
allow smaller amount of ice
allow less ice
- 1
- (so) less habitat
allow fewer places to live / nest
- 1
- (ii) **either** increase
as more sea to live in

or
as less competition for food

or decrease
as less space (ice) to lay eggs

or
predators more likely to eat them

there is no mark for increase / decrease alone. The mark is for an appropriate reason linked to increase / decrease if increase / decrease not ringed the mark may be awarded if it is clear in the explanation which is intended

1

(c) Living organisms show long-term changes.

1

[5]

Q15.

(a) (i) any **one** from:

ignore references to same lawn / weather / soil, which are not given in the question.

- (same) (type of) weed killer
- (same) volume / 5dm³ of solution used (on each area)
allow amount of solution used
*do **not** allow amount / volume / concentration of weed killer*
*do **not** allow number of daisy plants*
- effect on daisies (not other weeds / plants)
- (same) area / 10m²
- (same) time **or** (effect after) two weeks.

1

(ii) more (daisies) growing after use of weed killer **or** after two weeks
allow it does not fit pattern (of other results)

1

(iii) any **one** from:

ignore to see if it / water has an effect

- as a control
*do **not** allow as a control variable*
- to compare (to the other areas)
- to check other factor(s) are not affecting the results / daisies.

1

(iv) 80 (arbitrary units of weed killer) also killed all the daisies

allow ref to possible experimental design flaws such as 'only tested once' or 'not repeated' or 'different number of daisies in each area at first'

allow idea that other weed species may not respond in the same way as daisies

allow idea that 100 (units) may also kill wanted species / grass

1

- (b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking Guidance and apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1–2 marks)

Reference to at least one environmental factor plants respond to

or

at least one response

or

a named hormone

Level 2 (3–4 marks)

Reference to at least one environmental factor plants respond to

and

at least one associated response

or

reference to a named hormone

and

at least one associated response

Level 3 (5–6 marks)

Reference to at least one environmental factor plants respond to

and

at least one associated response

and

reference to a named hormone

Examples of biology points made in the response:

environmental factors

- light
allow phototropism
- (direction of the force of) gravity
allow gravi / geotropism
- moisture / water.
allow hydrotropism

effects on direction of growth

- shoots grow upwards
- shoots grow towards light
- shoots grow against (the force of) gravity
- roots grow downwards
- roots grow towards moisture
- roots grow towards (the force of) gravity.
allow reference to 'positive' and 'negative' in terms of tropisms as indicating direction of growth

hormone

- reference to auxin
allow other named hormone(s)
- unequal distribution of hormone causes unequal growth (rates).

allow higher concentration of hormone causes faster growth in shoots

allow higher concentration of hormone causes slower growth in roots

6

[10]

Q16.

- (a) gets more light (near surface)

allow warmer (near surface)

allow bladders contain (more) carbon dioxide

1

(so) photosynthesises more

1

(because) bladders aid floating (when tide is in)

or

(so) more biomass / glucose / starch produced

*ref to 'more' needed only once, eg gets more light for photosynthesis gains **two** marks*

if 'more' not given do not award mark on the first occasion

1

- (b) lets angler fish see / attract its prey / mates **or** see predators as it is dark (at 1000m)

or

lets angler fish see / attract prey to get food

or

lets angler fish see / attract mates to reproduce

or

lets angler fish see predators to avoid being eaten

*must be in a correct pair to gain **two** marks*

2

[5]

Q17.

- (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 /

- or
 a control variable is described
 or
 appropriate mathematical treatment of the data is described.

Examples of points made in the response:

- use of tape measure to produce transect
- transect placed coming out of shady area (e.g. woodland) into lighter area
- repeat transects
- samples at same height above ground
- samples at same aspect (N / E / S / W) on trees
- measurement of length, or width, of leaves using ruler
- measure several leaves at each location
- use of light meter to measure light intensity
- repeat measurements of light intensity on several days
- measure light intensities at same time of day
- calculate mean for each location
- plot graph of mean leaf length, or width, vs. light intensity.

allow attempt to overcome other variables – eg soil water / soil pH / temperature

[6]

Q19.

(a) any **three** from:

- parts of organisms have not decayed
accept in amber / resin
allow bones are preserved
- conditions needed for decay are absent
accept appropriate examples, eg acidic in bogs / lack of oxygen
- parts of the organism are replaced by other materials as they decay
accept mineralised
- or other preserved traces of organisms, eg footprints, burrows and rootlet traces
allow imprint or marking of organism

3

(b) (i) teeth for biting (prey)

must give structure + explanation

1

claws to grip (prey)

accept sensible uses

1

wing / tail for flight to find (prey)

1

(ii) any **two** from:

- new predators
- new diseases

- better competitors
- catastrophe eg volcanic eruption, meteor
- changes to environment over geological time
accept climate change
allow change in weather
- prey dies out **or** lack of food
allow hunted to extinction

2

[8]

Q20.

- (a) (i) correct bar heights
three correct 2 marks
two correct 1 mark
one or none correct 0 marks
ignore width

2

- (ii) (Stream Y)

has many sludge worms / bloodworms

or

has no mayflies / caddis or few shrimp

allow 1 mark if invertebrate not named but correct association given

1

which indicate medium or high pollution

1

- (b) (i) suspended solids increase (as a result of sewage overflow)

1

then decrease downstream / return to original levels

1

oxygen levels decrease (after sewage overflow)

1

and then rise again

1

- (ii) any **three** from:

- mayflies decrease (to zero) near overflow
accept 'have died out'
- because oxygen is low **or** mayflies have high oxygen demand
- mayflies repopulate / increase as oxygen increases again
- can't be sure if dissolved oxygen or suspended solids is the cause

3

- (c) they respire / respiration

aerobic respiration gains 2 marks

1

this requires / uses up the oxygen

1

[13]

Q21.

(a) (i) chloroplast

1

(ii) cell wall

1

(b) (i) osmosis

accept diffusion

1

(ii) cell wall (prevents bursting)

1

(c) (i) carbon dioxide

allow correct formula

1

glucose

allow sugar / starch

1

(ii) any **two** from:

- light sensitive spot detects light
- tells flagellum to move towards light
- more light = more photosynthesis

2

(d) (cell has) larger SA:volume ratio

1

short (diffusion) distance

allow correct description

1

(diffusion) via cell membrane is sufficient / good enough

or

flow of water maintains concentration gradient

1

[11]

Q22.

(a) (i) 10

1

- (ii) any **three** from:
- both increase with distance
 - more spp on walls than on trees
 - no lichen spp on trees for first 1 km from city
 - more steady / less erratic increase on trees than walls (or converse)
 - rate of increase increases with distance
- 3
- (b) SO₂ decreases with distance from centre
accept converse
Ignore pollution
- 1
- high SO₂ reduces survival or kills lichen
accept converse
- 1
- (c) (i) any **three** from:
- (line) transect
 - quadrat / reference to specific area
 - count number of lichens or coverage on trees
 - at regular intervals / set distances
- 3
- (ii) (more) Xanthoria nearest road
allow 'nitrogen-loving' for Xanthoria
- 1
- (more) Usnea further from the road
allow 'nitrogen-sensitive' for Usnea
- 1
- because most nitrogen oxide from vehicles (near road)
- or**
- because nitrogen oxide levels will be falling / less further away (from road)
- 1

[12]

Q23.

- (a) any **one** from:
- get lots of data
accept more reliable / reproducible
do not accept more accurate
 - cheap / free
 - unlikely to be biased
 - can cover a wide area at the same time / takes less time

- see seasonal variations 1
- (b) (i) correct bar heights 2
1 mark for each correct bar
ignore width of bars
- (ii) 12 800 2
(16000 / 100)x80 on its own for 1 mark
- (iii) goldfinch 1
- (c) any **one** from:
 - more food available
 - *accept fewer predators*
 - people feed them
 - *accept less habitat / food in countryside*
 - more rubbish / waste to eat 1

[7]

Q24.

- (a) (i) variation in masses / more representative / more typical / more reliable / average / mean / reference to anomalies 1
or
 one worm to light to measure change
do not allow more accurate / more precise
ignore fair test / valid / repeatable / reproducible
- (ii) remove solution / liquid (on outside of worm) 1
allow 'water'
- (iii) variable amounts removed from each worm 1
ignore reference to length of timing
- (iv) equal sizes of worm / more worms (in each group) / wash off all the sand / repeats / use more accurate balance / use smaller concentration intervals 1
allow reference to improve blotting technique eg blot before / blot more thoroughly
- (b) (i) different (starting) masses / sizes / weights (at different concentrations) 1

- allows comparisons / shows pattern / shows trend 1
- (ii) (+)20
correct answer = 2 marks, with or without working
or

$$\frac{7.5}{37.5} \times 100 \quad / \quad \frac{7.5}{37.5} \quad / \quad \frac{(45.0 - 1)}{37.5} \times 100$$
for 1 mark 2
- (c) (i) graph:
 points correct
allow ± 1 mm
-1 mark per error
allow ecf from part b(ii) 2
- label on x-axis including units – ie Concentration of salt in arbitrary units 1
- line of best fit = smooth curve / ruled straight line
anomaly (4.0, -52) either plotted and ignored re. line
or not plotted
do not allow point to point
allow best fit for ecf from 2bii 1
- (ii) on graph:
 ring drawn around point at (4.0, -52)
allow (5.0, -50) if cand. line indicates this 1
- (iii) sensible suggestion – eg used wrong solution / used 5.0% instead of 4.0% / different length of time in solutions / ref to error in blotting / balance not zeroed / error in weighing
allow some lugworms died
allow error in calculation 1
- (d) (i) 2.9 to 3.0 / correct for candidate's graph ± 0.1 1
- value of no change in mass / worms in equilibrium with soln / described
allow small(est) mass change 1
- (ii) water loss 1
- by osmosis / diffusion 1

from dilute region in the worm to more concentrated solution outside
*allow correct description in terms of high to low water
 concentration / high to low water potential
 salt solution is hypertonic
 concentration unqualified = salt concentration*

1

[19]

Q25.

- (a) (i) traps light (energy)
allow uses light / converts light energy to chemical energy

1

for photosynthesis / for making sugar / starch / carbohydrates
*ignore food
 allow organic molecules*

1

- (ii) dodder takes sugar / glucose / sucrose from phloem / dodder cannot
 make its own glucose / carbohydrate

or

phloem has sugar / glucose / sucrose
*accept amino acids / fatty acids / other small organic
 molecule
 ignore takes food / minerals / water / nutrients*

1

- (iii) any **one** from:

- not enough sugar / nutrients to grow / respire
accept not enough food to grow / respire
- might strangle / restrict growth by squeezing stem tightly
- may damage stem tissues by growing into it
- may smother leaves / block light **so** less photosynthesis / less
 growth

1

- (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)

Description and explanation of an adaptation which only involves hooks **and /**
or suckers.

Level 2 (3 – 4 marks)

Description and explanation of adaptations including hooks **and / or** suckers

with any other adaptation **or** explanation.

Level 3 (5 – 6 marks)

Description of most correct adaptations **and** explanations.

Examples of biology points made in the response:

- hooks – for holding on / not being detached
- suckers – for holding on / not being detached
- flattened / large surface area – absorption of (large amounts of) food
- no gut – not needed as host digests food
- thick cuticle – protection from host's enzymes / so not digested
- large number of eggs – increased chance of infecting new host
 - allow hermaphrodite and self-fertilising – likely to be just one worm per host*
 - internal fertilisation – gametes not digested*

6

[10]

Q26.

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1 – 2 marks)

At least **one** way in which animals **and / or** plants are adapted to survive.

Level 2 (3 – 4 marks)

A description of ways in which animals **and / or** plants are adapted **and** an attempt to link at least **one** adaptation to how it increases the chance of survival.

Level 3 (5 – 6 marks)

A description of ways in which animals **and** plants are adapted **and** a description of how at least **one** adaptation increases the chance of survival.

examples of biology points made in the response:

(animals)

(A) change / decrease in surface area / example
(decrease in surface area which) reduces area from which sweat / water may be lost

(A) hump with fat / fat stores
(fat in hump) to convert to water (via respiration)

(A) long eyelashes
(long eyelashes) to keep (wind-blown) dust out of eyes

(A) nocturnal / 'keep out of the sun'
reduce sweat loss (in heat of the day)

extra information

allow adaptations of specific animals to living in specified dry conditions, eg a desert

*(A) change / increase in surface area / example
(increase in surface area which) increases area heat may be lost from (by radiation)*

*(A) changes to thickness of insulating coat
(thicker coat on upper surface) increases insulation from sun's heat*

*(A) thin (layer) / reduced amount of body fat
(reduced amount of body fat which) reduces insulating layer*

*(A) wide feet
(wide feet) to reduce pressure / spread weight / prevent sinking*

(plants)

(A) decrease in surface area

(A) leaves are spikes
(reduced area / leaves are spikes) reduces water loss / transpiration / evaporation

(A) long / wide spread / extensive roots
(long / wide spread / extensive roots) to absorb (more) water

(A) fleshy / thick stem
(fleshy / thick stem) to store water

extra information

allow adaptations of specific plants to living in specified dry conditions, eg a desert

*(A) thick wax
(thick wax) to reduce evaporation / water loss / transpiration*

*(A) few(er) stomata
(few stomata) to reduce evaporation / water loss / transpiration*

[6]

Q27.

(a) microorganisms

allow microbes / bacteria / fungi / decomposers

1

(microorganisms) respire

*do **not** allow dead plants respire*

1

(respiration / decay / microorganisms) releases (thermal) energy / 'heat'
ignore produce 'heat'
*do **not** allow produce energy*
*do **not** allow dead plants release 'heat'*

1

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

- (opening) allows oxygen in
- microorganisms / eggs need oxygen
allow air for oxygen
- oxygen needed for respiration
- (opening) allows release of carbon dioxide (from microorganisms / respiration / eggs)
allow gaseous exchange (1 mark) of / for microorganisms / eggs (1 mark) if none of first four points given
- (opening) allows energy / 'heat' to escape
- (closing) retains energy / 'heat' if too cool / at night
*if no mark awarded for either of these points allow 1 mark for vents open in the day to prevent overheating **and** close at night to prevent it getting too cold*
- (closing) retains moisture
allow (opening) releases moisture

3

(ii) any **one** from:

- maintains sex balance
e.g. equal / best / correct numbers of male and female
- (survival of species depends on there being) males and females in population
allow so the offspring are not all the same sex

1

[7]

Q28.

(a) any **three** from:

- place 30-m tape measure across field / from one wood to the other
- place quadrat(s) next to the tape
- count / record the number / amount of dandelions / plants in the quadrat
ignore 'record the results'
ignore measures / estimates dandelions
- repeat every 2 metres
allow every metre / at regular intervals

3

(b) (i) low light / it is shady

allow no light

ignore sun / rays

or

not enough water / ions / nutrients

accept correct named ion
ignore no water / ions / nutrients

or

wrong pH of soil
accept competition with trees for light / water / ions
ignore competition for space and competition unqualified
accept soil too acidic / too alkaline
ignore temperature

1

(ii) sensible suggestion for a small area, eg chance variation / anomaly /
 poisoned by animal waste / wrong pH of soil / eaten (by animals) / cut
 down / footpath

1

(c) repeat (transect) / compare with the results of other groups
allow 'do it in two different locations' for 2 marks

1

at different / random location(s) / elsewhere (across the field)
*do **not** allow 'in other fields'*

1

[7]

Q29.

(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 CO₂

1

(so) more photosynthesis
allow 1 mark for light for photosynthesis

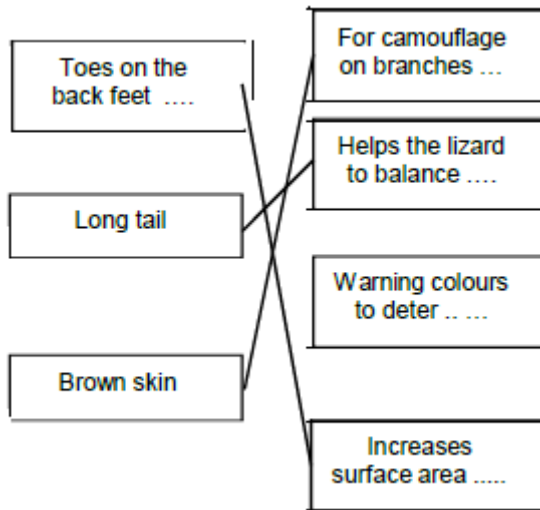
*allow 1 mark for CO₂ for photosynthesis
 ignore reference to oxygen for respiration
 'more' only needed once for 2 marks*

1

[8]

Q30.

(a)



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

3

(b) escape (predators)

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

1

(c) food

1

territory

1

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

[6]

Q31.

(a) any correct named physical environmental condition, e.g. light / water / rain / temperature / minerals / nutrients / space (between plants)

ignore carbon dioxide / climate / weather / sun / pollution

1

genes / inheritance

ignore 'variety'

OR

- any correct named biotic factor e.g. predation / disease 1
- (b) mass of crop also depends on number of pods (per plant) / size / mass of each pea 1
ignore number of plants
- (c) microorganisms / bacteria / fungi / decomposers / detritus feeders / named 1
 decompose / rot / break down / decay / digest 1
ignore feed / eat
- (these organisms) respire 1
*do **not** allow respiration by pea (plants)*
- (decay / respiration / microorganisms etc) releases carbon dioxide 1
*do **not** allow combustion / fossilisation*
- [7]**

Q32.

- (a) extremophile(s) 1
- (b) (i) common (periwinkle) and flat (periwinkle) 1
*either order, **both** required*
- (ii) (common and flat) both live in the same habitat / area / named area 1
allow habitats overlap the most
- (iii) any **two** from: 2
- would have wrong food
 - would otherwise be exposed to (specific) predators
 - cannot tolerate extended exposure to air **or** reduced submersion in seawater 1
allow cannot tolerate temperature / dehydration
 - cannot tolerate high salt concentration (in rock pools) 1
allow low salt concentration (in rock pools)
 - cannot compete with small periwinkle
- [5]**

Q33.

- (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 at high latitude
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]

Q34.

- (a) (i) 5.2
*award **2** marks for correct answer, irrespective of working or lack of it*
*award **1** mark for $62.4 \div 12$ 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]

Q35.

(a) use of quadrat / point frame
allow description 1

randomly placed / random sampling
ignore reference to transects 1

(b) (i) 6 1

(ii) more light 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 intensity 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]

Q1.

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

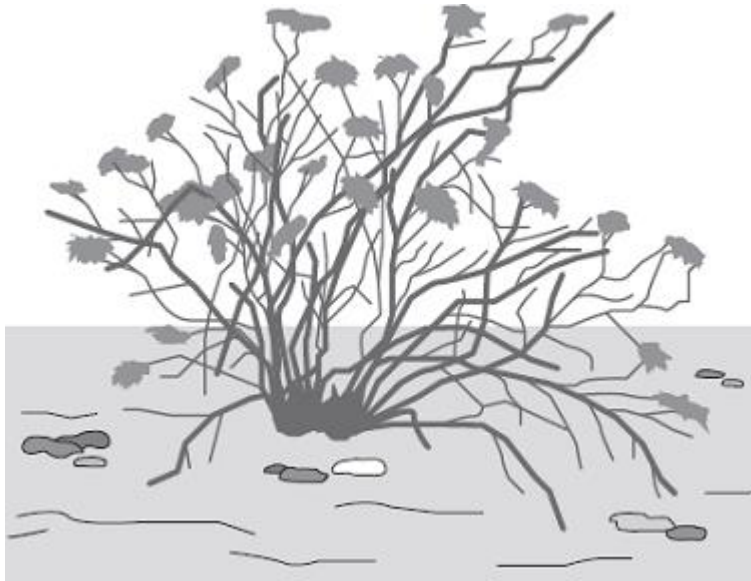
- (a) Plants may have to compete with other plants.
(i) Name **two** things for which plants compete.

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)

Q2.

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

(a) The photograph shows an arctic fox.



By Algalv (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.

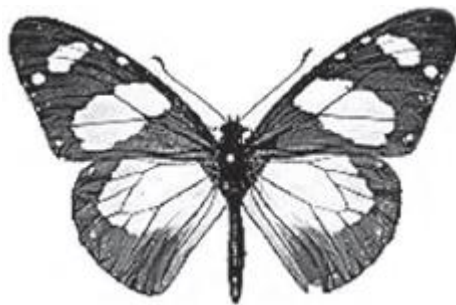
Adaptation _____

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

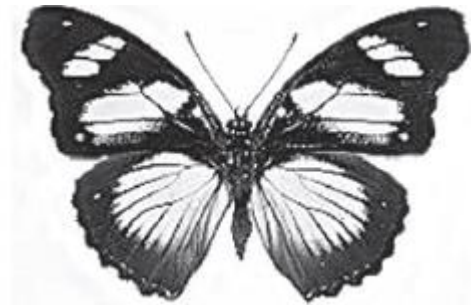
(2)
(Total 6 marks)

Q3.

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*.

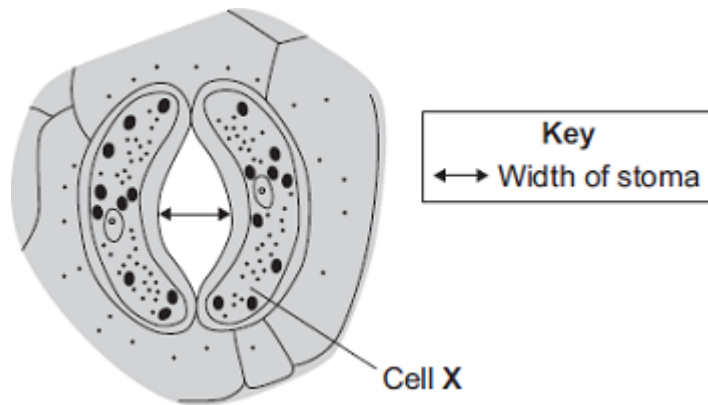
(2)

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

(3)
(Total 5 marks)

Q4.

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)

Q5.

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.*

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



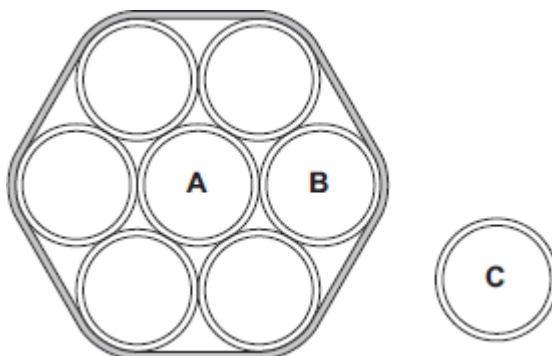
© Fuse

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)

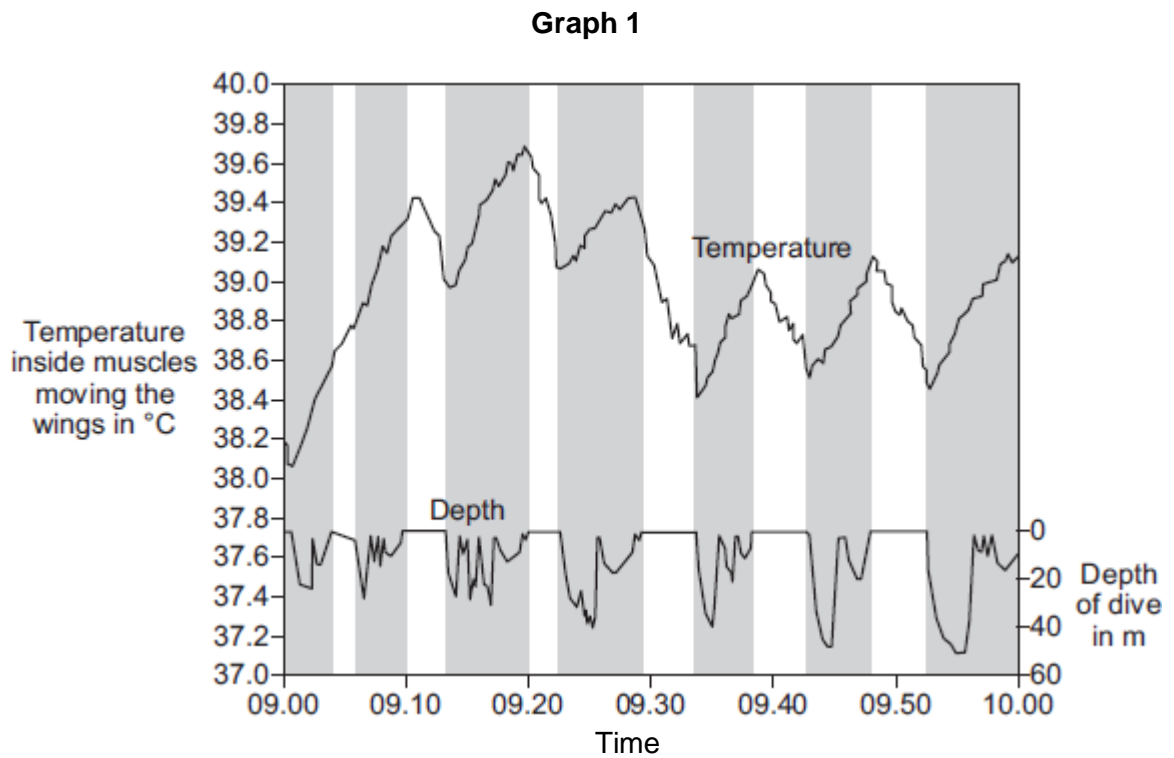
(d) Describe how blood vessels help control human body temperature.

(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.



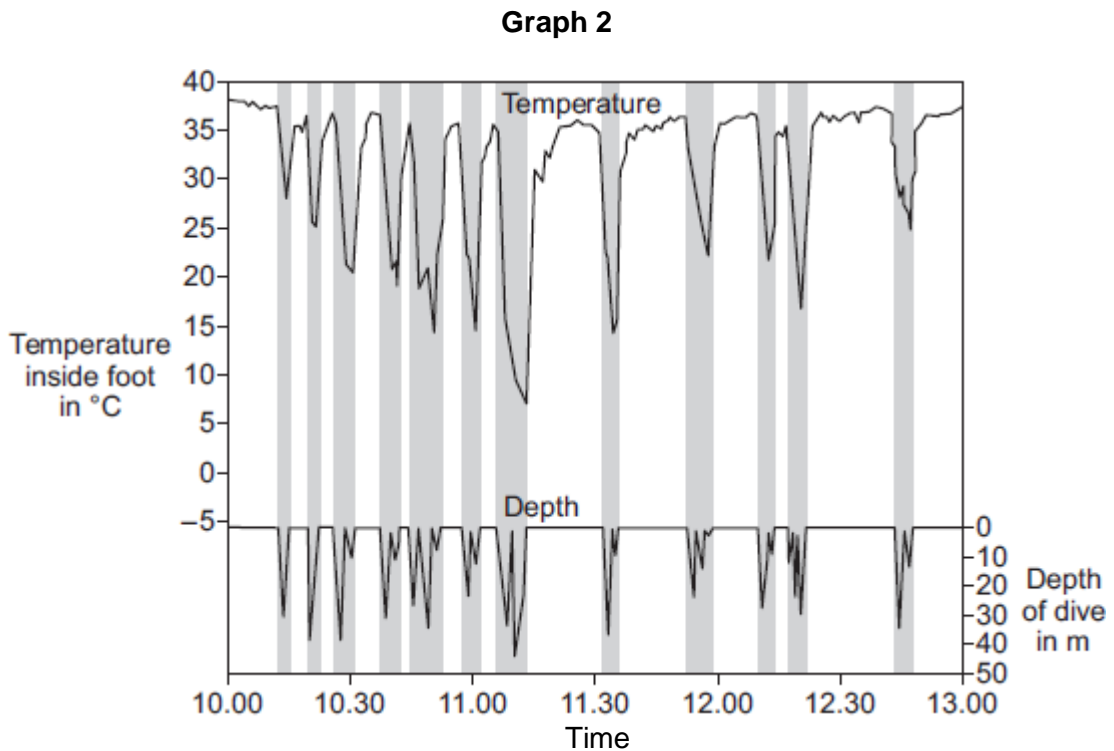
© Reprinted from Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology, Volume 135, P.J. Ponganis, R.P. Van Dam, D.H. Levenson, T. Knowler, K.V. Ponganis, G. Marshall, Regional heterothermy and conservation of core temperature in emperor penguins diving under sea ice, pp 477-487, copyright 2003, with permission from Elsevier

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.



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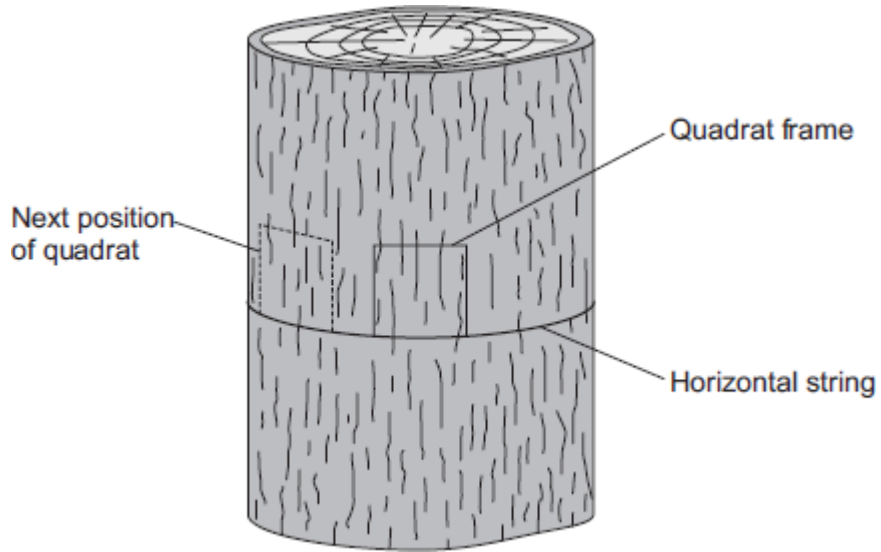
Suggest an explanation for the changes in temperature inside the penguin's foot as it dives.

(3)

(Total 22 marks)

Q7.

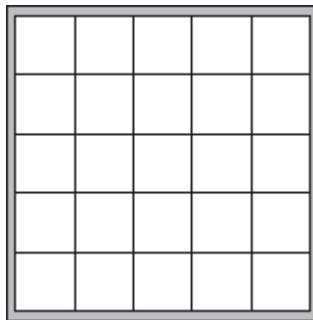
Students investigated the distribution of a green alga on a tree trunk.



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.

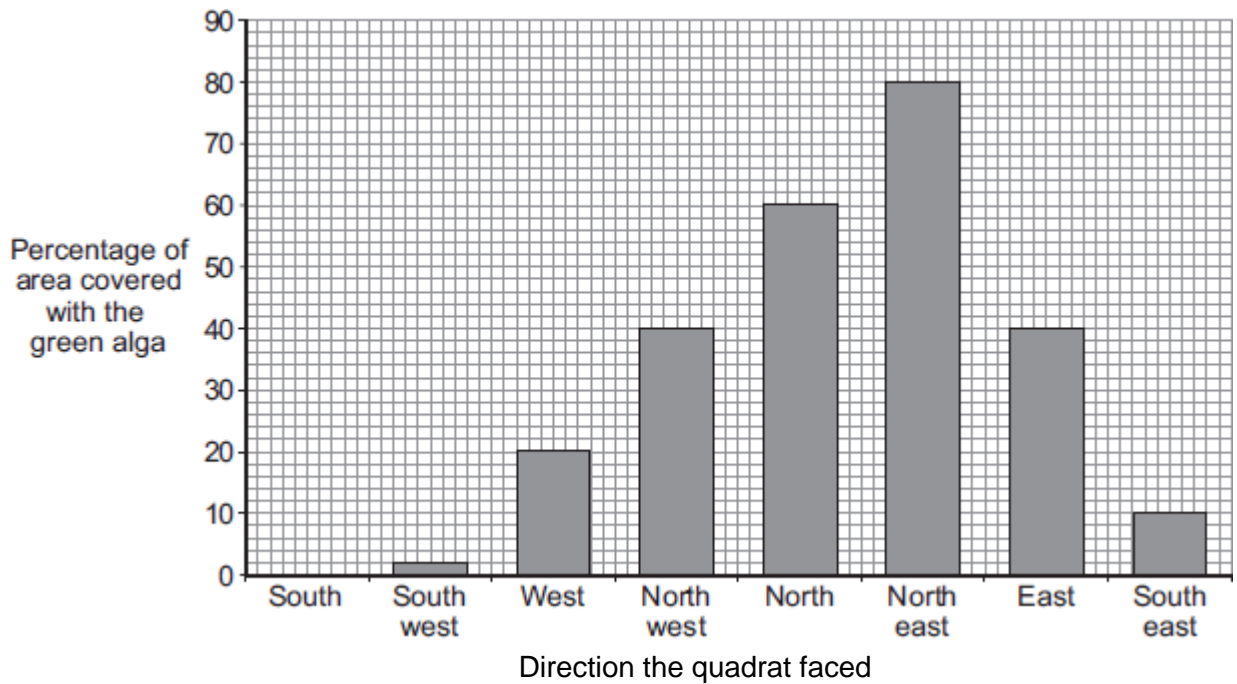
(a) The diagram shows the quadrat the students used.



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. _____

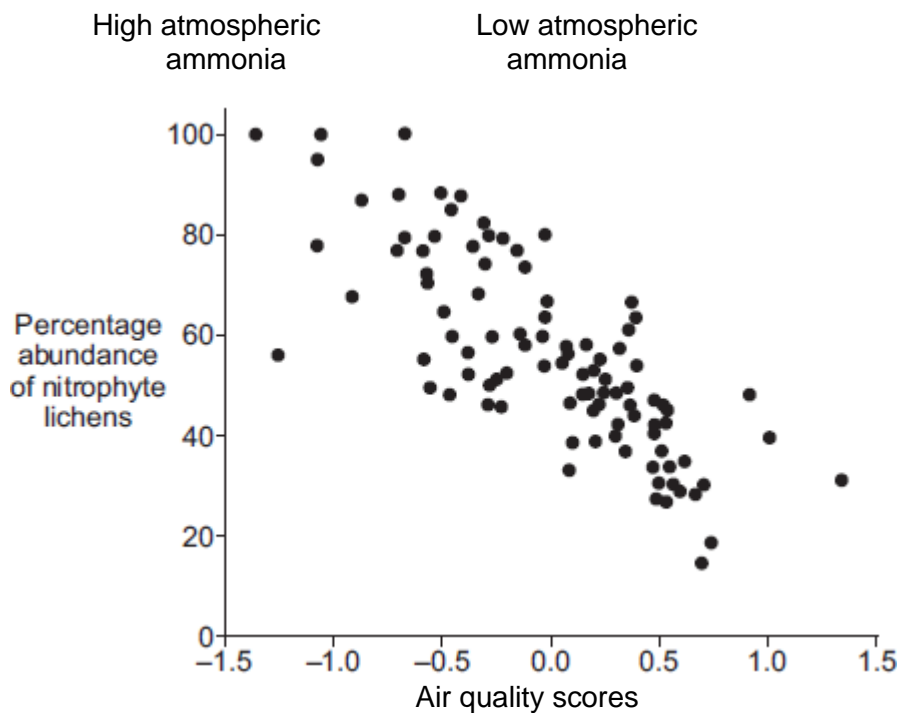
(3)

- (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)

Q8.

Many organisms are adapted to avoid being eaten.

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



© Thomas Marent/ardea.com

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)

Q9.

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

© Kim Taylor/Warren Photographic

- (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)

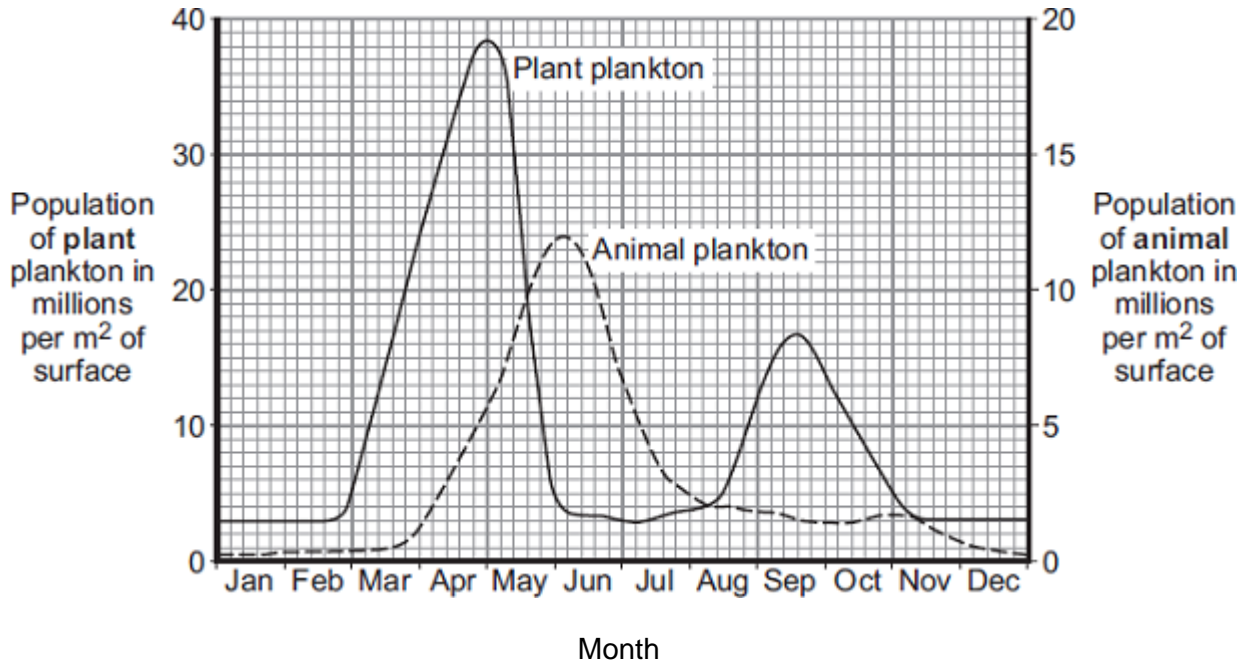
(Total 9 marks)

Q10.

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

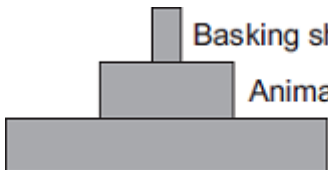
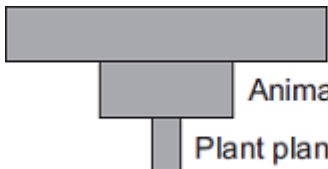



(a) Basking sharks eat animal plankton. Basking sharks grow up to 8 metres long.

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

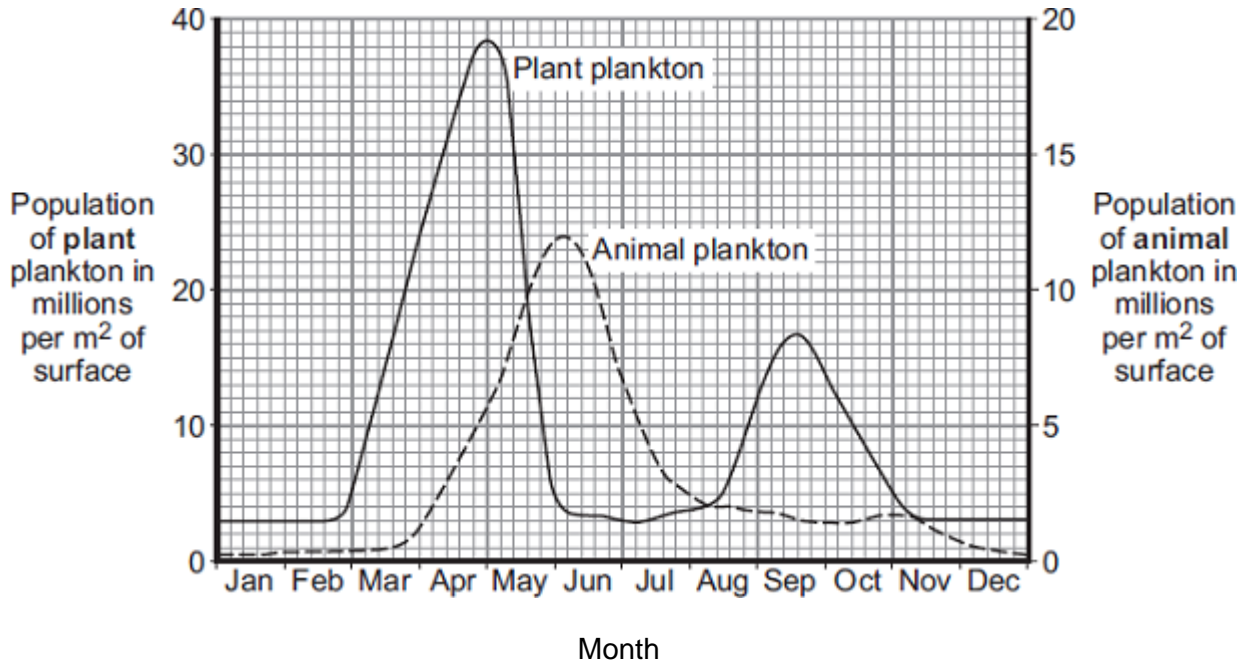
Which is the correct shape for the pyramid of biomass to show the relationship between plant plankton, animal plankton and basking sharks, in June?

Tick (✓) **one** box.

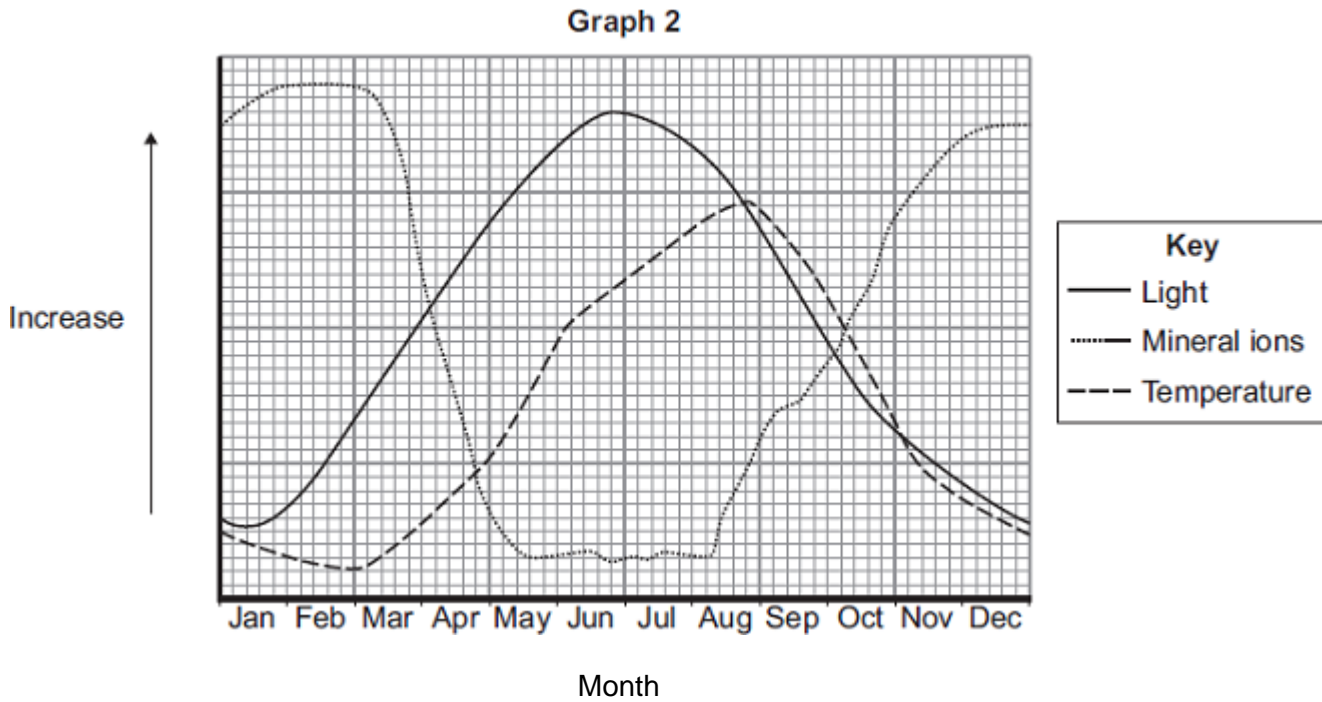
		<input type="checkbox"/>
		<input type="checkbox"/>
		<input type="checkbox"/>

(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.



(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)

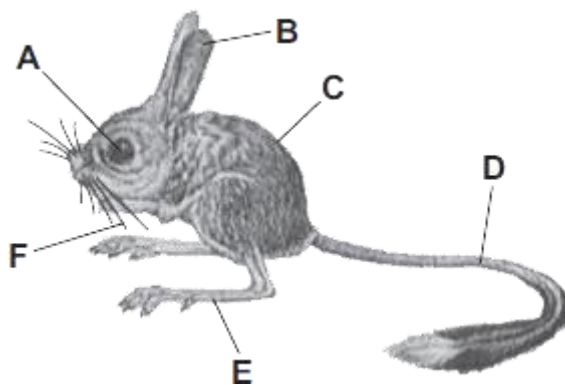
- (d) The concentration of mineral ions changes between February and December.
Suggest explanations for the changes.

(3)

(Total 8 marks)

Q11.

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)

Q12.

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.

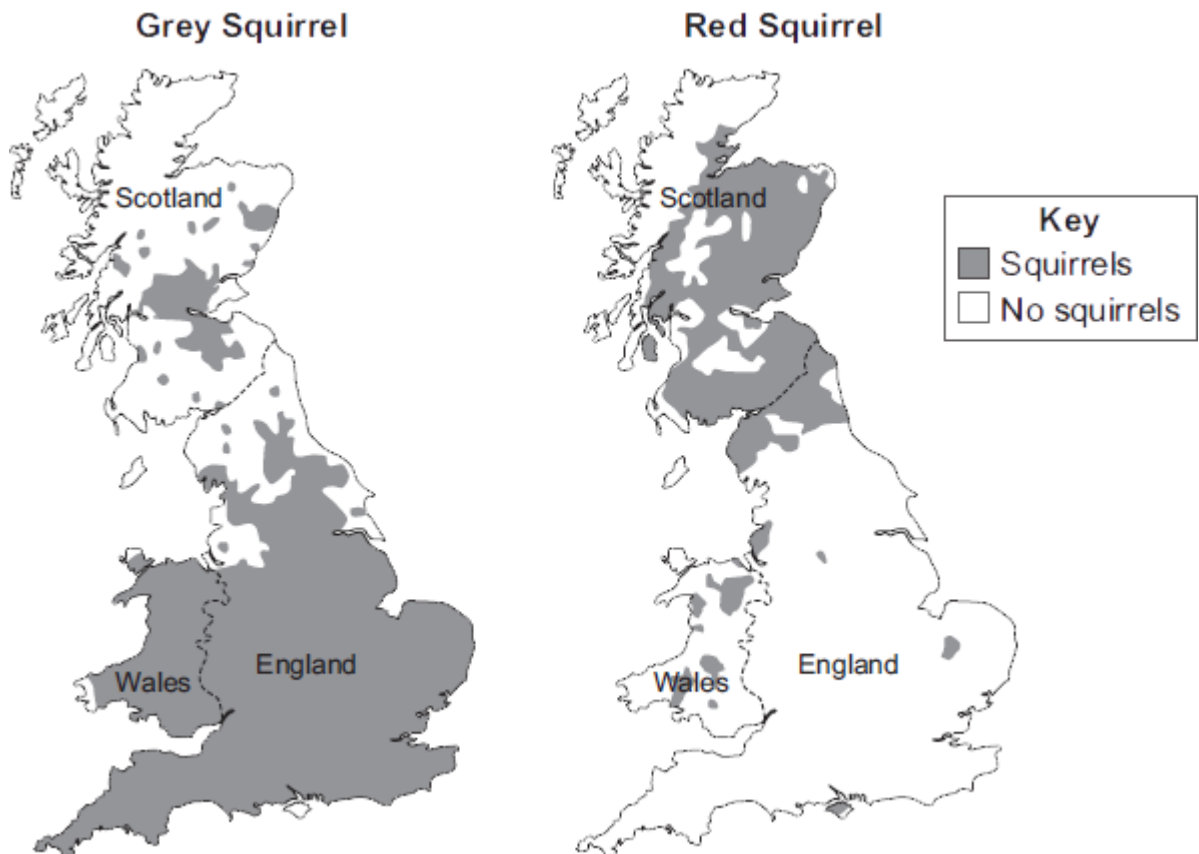


Image under Crown Copyright and courtesy of Pepper & Patterson, 2001.
Contains public sector information licensed under the Open Government Licence v1.0

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.

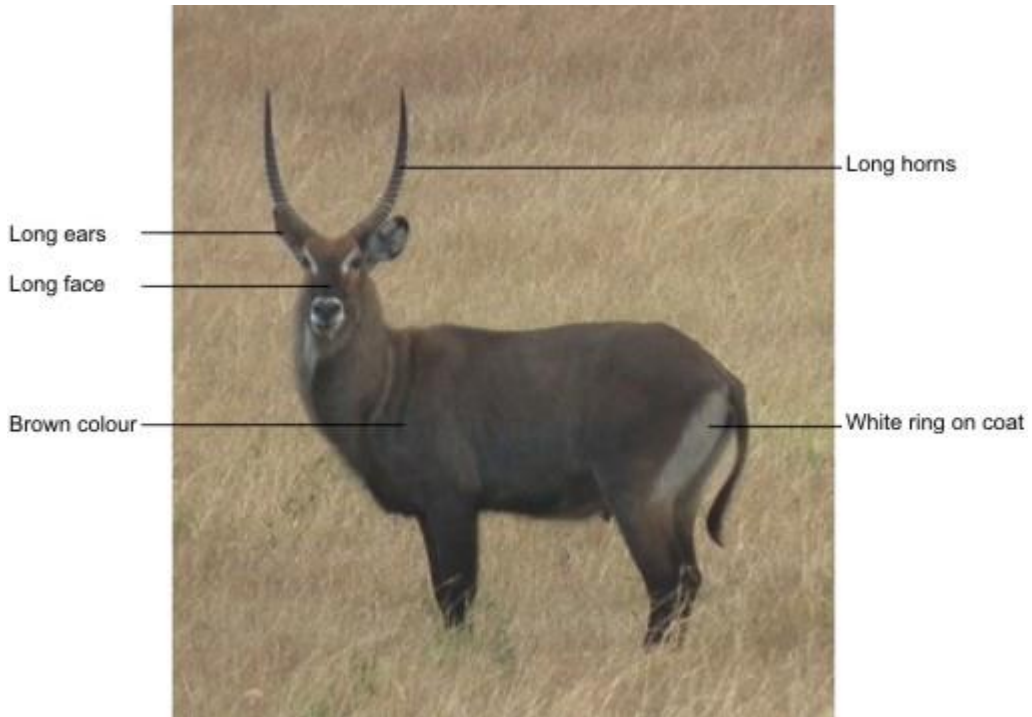
Use information from **Table 2**.

(3)
(Total 7 marks)

Q13.

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)

Q14.

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.

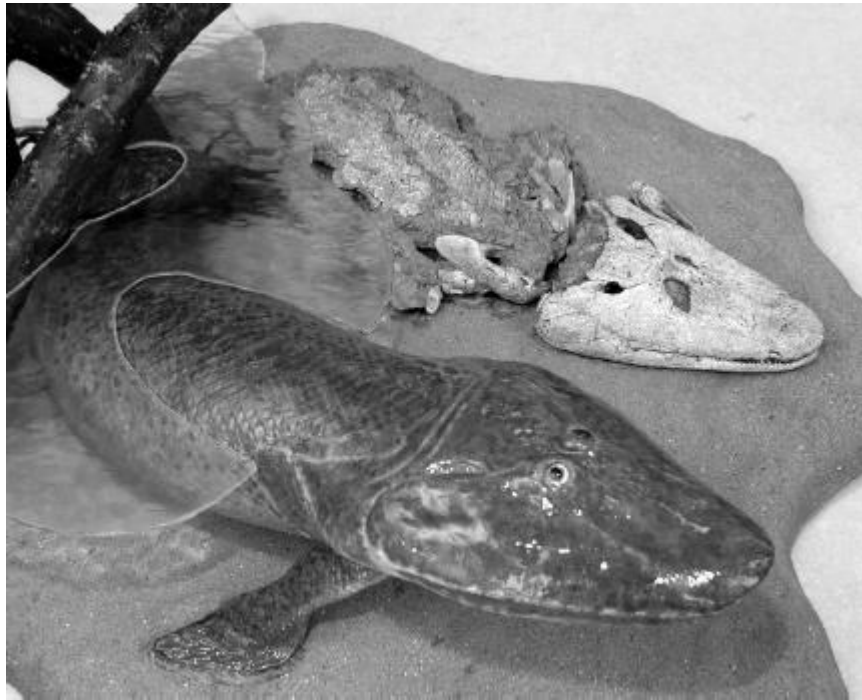


Image © University of Chicago, Shubin Lab. Model by Tyler Keillor

- (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)

Q15.

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)

Q16.

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

(Total 3 marks)

Q17.

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.



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)

Q19.

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.

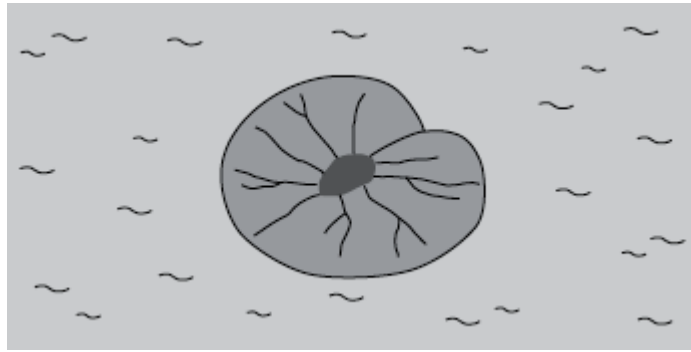
(Total 3 marks)

Q20.

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.

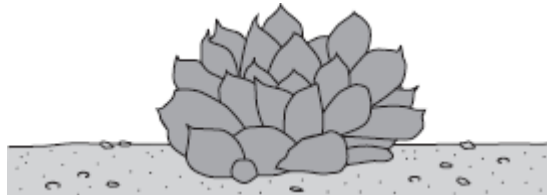


Thorns help this plant survive.

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)

Q21.

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)

Q22.

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)

Q23.

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

Q24.

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.



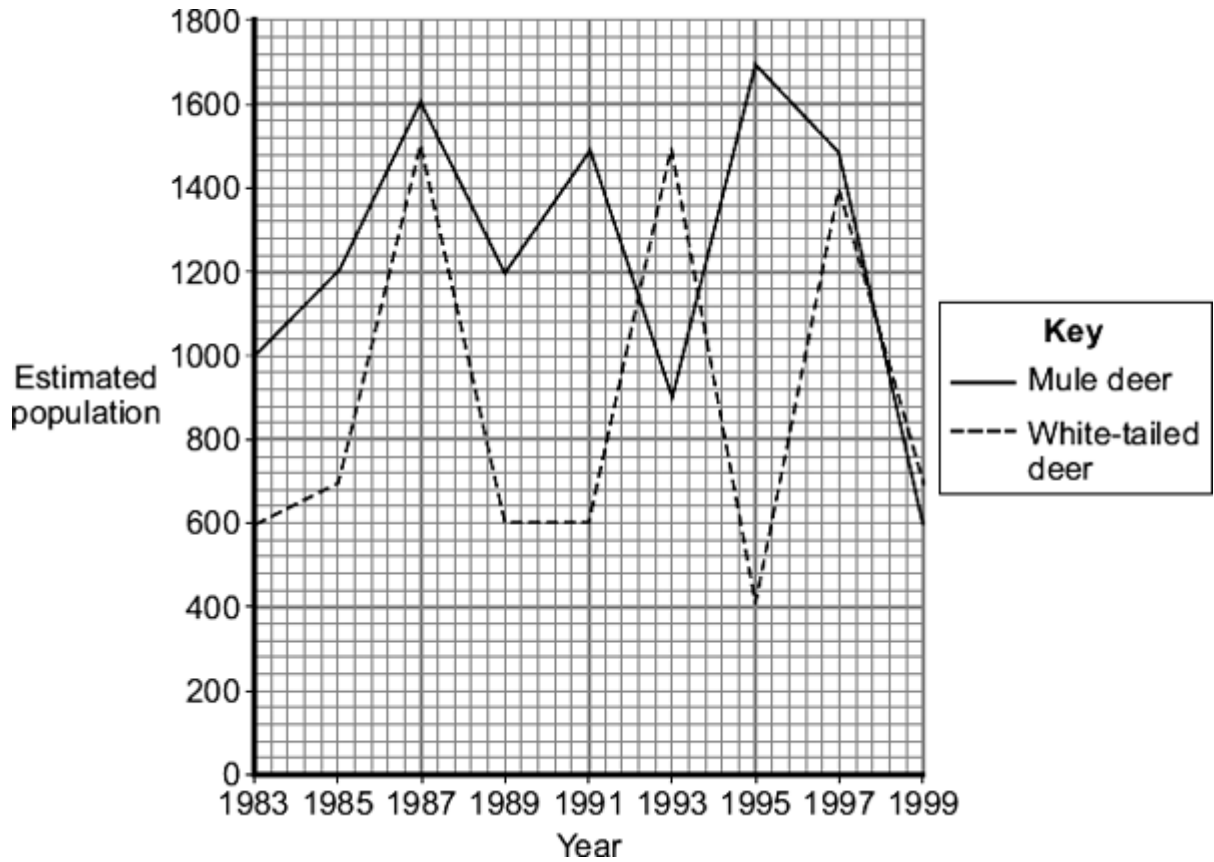
Mule deer

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)

Q25.

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)

Q26.

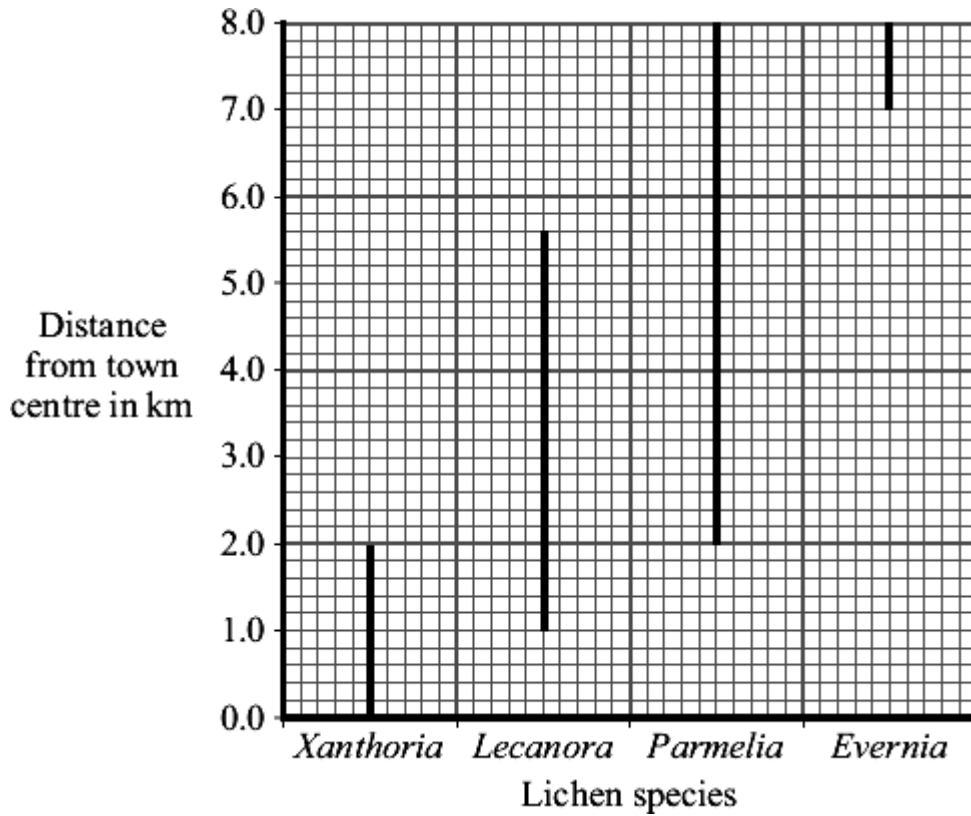
Lichens are sensitive to the amount of sulfur dioxide in the atmosphere. They are used as indicator species for the amount of air pollution. Air pollution is generally higher in town centres than in the countryside.

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)

Q27.

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)

Q28.

The photograph shows an armadillo.



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.

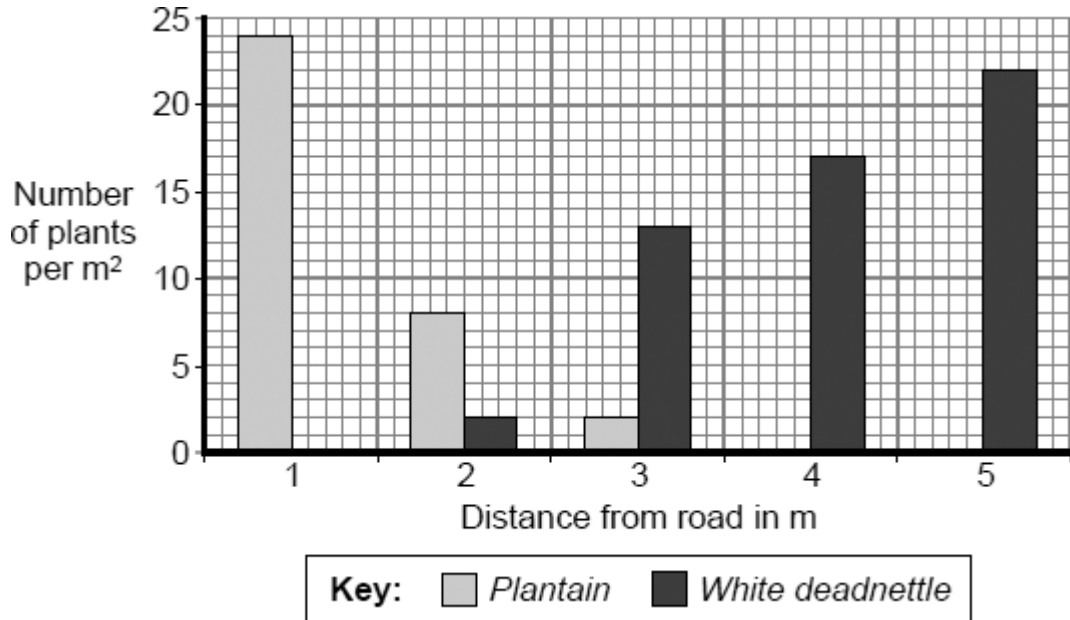
(1)

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

(1)
(Total 4 marks)

Q29.

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 1m² 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)

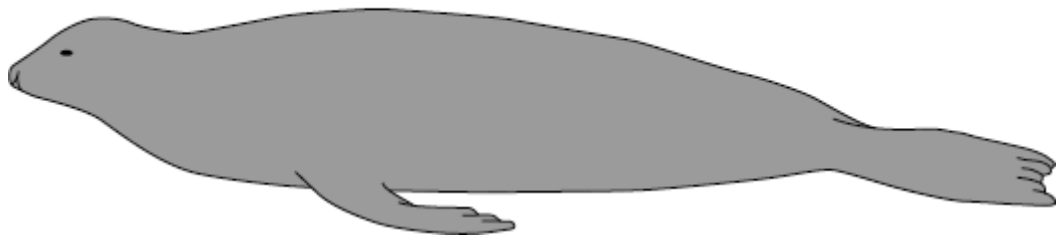
Q30.

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.

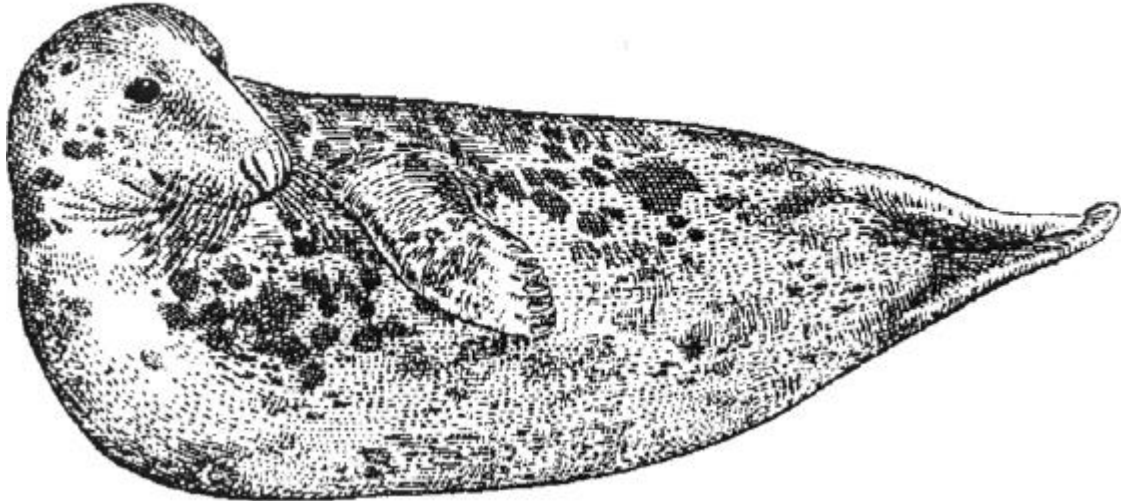
1. _____

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)

Q31.

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.



© S.J. Krasemann / Peter Arnold / Still Pictures

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)

Q32.

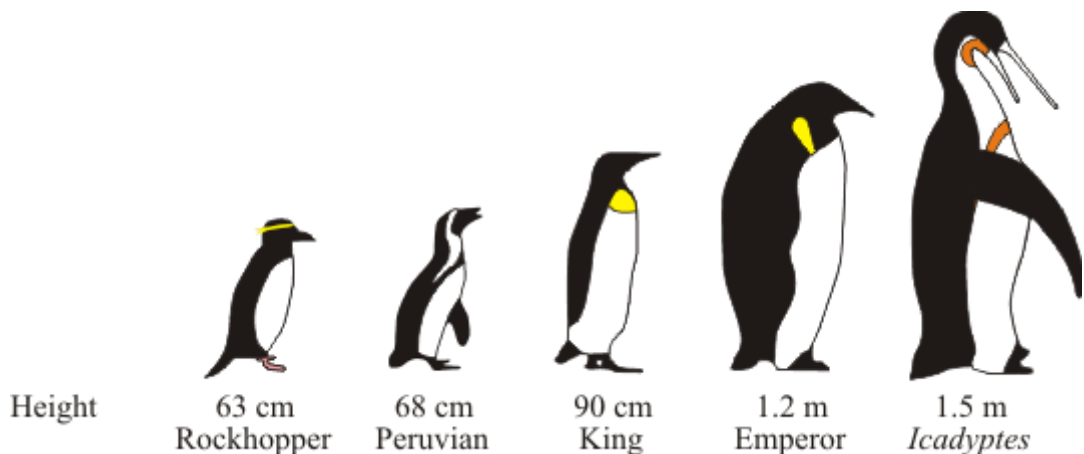
(a) Explain, as fully as you can, how natural selection leads to evolution.

(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)

Q33.

Some organisms are in danger of extinction.
The photograph shows an African elephant feeding on tree leaves.



(a) Read the information about elephants and humans in Africa.

- The African elephant is the largest land animal.
- The African elephant feeds on lots of leaves.
- Adult African elephants have no natural predators.
- Elephants are killed by poachers for their ivory tusks.
- African elephants live for about 70 years.
- Most African elephants live in large herds.
- Land available to elephants is disappearing rapidly.

The African elephant is now extinct in many parts of Africa.

Use information from the list to give **three** reasons why.

1. _____

2. _____

3. _____

(3)

(b) Organisms that are in danger of extinction can be cloned.

List A gives the names of three different cloning techniques.

List B gives information about these techniques.

Draw a line from each technique in **List A** to the correct information about it in **List B**.

List A Technique	List B Information
Adult cell cloning	Small groups of cells from parts of a plant are grown on a special jelly.
Embryo transplanting	Cells from a developing animal are separated before they become specialised and then placed into host mothers.
Tissue culture	Genes are cut out from chromosomes and inserted into other organisms.
	A nucleus is removed from an unfertilised egg cell. The nucleus from a body cell is inserted into the egg cell. An electric shock causes the egg to start to divide.

(3)

(Total 6 marks)

Q34.

Swallows and swifts migrate between Britain and South Africa every year.

(a) **Photograph 1** shows a swallow.

Photograph 1



Swallows can fly very quickly.

Use information from the photograph to give **one** way in which the swallow is adapted for flying very quickly.

(1)

(b) **Photograph 2** shows swifts.

Photograph 2



Swallows and swifts both feed on flying insects.
They both spend the summer in Britain and then migrate to South Africa in the autumn.

Suggest **one** reason why swallows and swifts do not stay in Britain in the winter.

(1)

(c) The table gives data about swallows and swifts.

	Swallows	Swifts
Arrival date in Britain	April	Early May
Leaving date from Britain	October	Early August
Food	Flying insects	Flying insects
Height at which the birds feed	Near ground level	Up to 350m above ground level
Times at which birds feed	Mainly when it is light	Almost 24 hours per day

(i) There is very little competition between swallows and swifts for food.

Use information from the table to suggest **two** reasons for this.

1. _____

2. _____

(2)

(ii) Swallows and swifts do compete for some factors.

Suggest **one** of these factors.

(1)

(Total 5 marks)

Q35.

The drawing shows a poison-dart frog.



- (a) The poison-dart frog moves mainly by jumping.

Use information from the drawing to suggest **one** way in which this frog is adapted for jumping.

(1)

- (b) Use the information below to suggest how the poison-dart frog is adapted for survival.

- This poison-dart frog is bright blue in colour.
- Animals that eat poison-dart frogs become very sick.

(1)

(Total 2 marks)

Mark schemes

Q1.

- (a) (i) any **two** from:
ignore oxygen / food / sun / carbon dioxide
- light
 - water
 - space
 - nutrients / ions / minerals / named
accept two named minerals / ions for 2 marks
- 2
- (ii) less competition for water
ignore space / light / food
- or**
- more water / nutrients / minerals available
- 1
- (b) camouflage / same shape as leaf / looks like a leaf
allow 'blends in'
ignore colour
- 1

[4]

Q2.

- (a) 1 mark for each adaptation and 1 mark for its correct linked advantage
- long / thick hair / fur (1) for insulation (1)
allow keeps warm
 - small ears (1) for reduced heat loss (1)
 - small feet (1) for reduced heat loss (1)
ignore wide feet
ignore prevent sinking
 - white fur / coat (1) for camouflage / poor emitter (1)
 - small SA/V ratio (1) reduces heat loss (1)
 - thick layer of fat (1) insulates / keeps warm (1)
- Max 4**
- (b) 1 mark for an adaptation and 1 mark for its correct linked advantage
- horns (1) for defence (1)

- long legs (1) for speed / escape / vision (1)
- light colour (1) for camouflage (1)
allow pattern
- eyes on side of head (1) for wider field of vision (1)
- hooves (1) for speed / escape (1)
- large ears (1) to hear predators better (1)

Max 2

[6]

Q3.

- (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]

Q4.

- (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

Q5.

(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

Q6.

(a) any **three** from:

- streamlined shape enables it to swim quickly (to catch fish)
- wings (provide power) to move quickly (to catch fish)
allow 'flippers'
- wings used for steering

- white underside / dark top acts as camouflage (so prey less likely to see it)
- long / sharp beak to catch fish

3

(b) any **three** from:

- reduces (total) surface area of penguins exposed to wind / cold atmosphere
- reduced number of penguins exposed (to wind / cold)
accept reference to movement in or out of the huddle
accept outer ones insulate / act as barrier
- reducing heat loss
allow reduced cooling
- 'share' body warmth / heat

3

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

- size of tubes
- volume of (hot) water
accept amount of (hot) water
- left for same length of time
allow measured at same time intervals
- starting temperature

2

(ii) any **two** from:

- tube alone (**C**) lost heat most (rapidly)
- tube **B** intermediate
- tube **A** least (rapidly)
allow correct use of figures for all 3 tubes
ignore just quoting final temperature

2

(iii) confirms suggestion

no mark awarded
accept correct answers referring to other suggestions in (b)

since (both outer and inner) tubes in bundle lost heat less rapidly (than 'stand – alone' tube)

comparison needed

1

penguins in a huddle lose less heat (than single ones)

accept 'it is the same for penguins'

1

(d) **if the core body temperature is too high**

blood vessels supplying the skin (capillaries) dilate / widen

*accept reference to arteries / arterioles but **not** veins / capillaries*

*do **not** accept references to movement of blood vessels*
ignore enlarge / expand

reference to skin / surface required only once

1

so that more blood flows through the (capillaries) in skin / near surface

reference to 'more' needed at least once to gain 2 marks

1

and more heat is lost

reference to 'more' needed at least once to gain 2 marks

1

if the core body temperature is too low

blood vessels supplying the skin (capillaries) constrict / narrow

allow full marks if 'too low' given first

if no other marks awarded, allow vasodilation when too warm

and vasoconstriction when too cold for 1 mark

1

(e) (i) wings move to provide movement for diving

allow muscles contract / work

1

energy (for movement) comes from respiration

*do **not** allow produces / makes / creates energy*

allow energy comes from / is supplied by / is released by respiration

1

respiration / muscle contraction also releases heat

allow produces heat

1

(ii) any **three** from:

- feet not / less used **or** no muscle contraction in feet

allow little energy / heat released through respiration in feet

*do **not** allow veins / capillaries*

- vessels supplying feet constrict / less blood to feet

- so temperature in feet cools / decreases

- more heat loss from large surface area or rapid flow of cold water over foot

3

[22]

Q7.

(a) estimate / count number of squares covered

*do **not** allow number of squares containing algae*

1

divide by total number of squares and multiply by 100 / multiply by 4

1

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

- more / most in North east facing
 - followed by the North facing
 - the South facing had no green alga / least
- 2
- (ii) 40 (%) 1
- two directions had this value (rest of directions had only one)
accept this is the most common percentage / value
2nd mark only if 40(%) 1
- (iii) any **three** from:
- light / sunlight
ignore Sun / carbon dioxide
 - temperature
*do **not** accept oxygen*
 - availability of water / humidity
 - availability of nutrients
 - wind
 - pollution qualified eg SO₂, acid rain, soot
 - grazing by animals eg slugs
 - competition with other species
 - pH
- 3
- (iv) eg (*for light*)
- allow overlap between factors*
- light intensity *least* on north / north east facing parts of tree (1) 1
- green algae adapted for photosynthesis in low light intensities (1)
allow, since less light from Sun, cooler so less evaporation 1
- negative effect of high light intensity on green algal chlorophyll /
 photosynthetic pigments (1)
allow green algae unable to withstand desiccation 1
- or** (*for temperature*)
- temperature highest on south (and west) facing parts of tree
 (causing) more water to evaporate from this side of tree
 green algae unable to withstand desiccation
- or** (*for moisture / rainfall*)
- rainfall highest on north / north east facing parts of tree (1)
 (giving) more moisture on this part of tree (1)

green algae less likely to desiccate (1)

or (*for wind*)

wind speed / duration greatest on south (and west) facing parts of tree (1)

(causing) more water to evaporate from this side of tree (1)

allow wind carries pollutants

allow pollutants toxic to algae

green algae unable to withstand desiccation (1)

or (*from pollution*)

from south / south west (1)

wind carries pollutants (1)

pollutants toxic to / kill algae (1)

- (c) (i) as the concentration of ammonia increases so does the % abundance of nitrophyte lichens

allow positive correlation / proportional

allow directly proportional

1

scattered results / wide spread

allow use of approximate numbers to demonstrate scattering

or

for any value of one parameter there is a wide range of the other

allow not a strong relationship / correlation

1

- (ii) not very useful / unreliable

accept only gives a rough idea / only a general indication

1

for any value of one parameter there is a wide range of the other

allow correlation rather than direct relationship

or

scattered results

1

[16]

Q8.

- (a) looks like a leaf

1

so predator less likely to / won't see it

- allow 'camouflage' as alternative to either point* 1
- (b) (i) thorns (of acacia tree) hurt (predators)
allow idea that fewer animals / predators live in trees or ground living animals can't reach them (in the trees) 1
- (ii) (giraffe) avoids being bitten by ants
allow ants are poisonous / have unpleasant taste 1
- (c) looks like / mimics a wasp **or** has warning colouration 1
- so predators think it has a sting 1

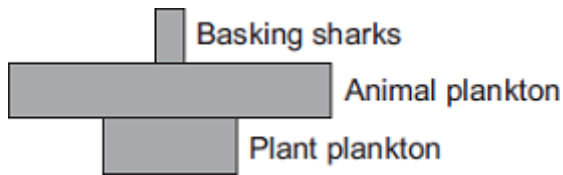
[6]

Q9.

- (a) sulfur dioxide 1
- (b) (i) mutation 1
- (ii) pale form now (more) easily seen (by predators) **or** dark form now less easily seen (by predators)
accept ref to camouflage 1
- so pale form (more) likely to be eaten **or** dark form less likely to be eaten 1
- so dark form (more likely to) breed / pass on genes
- or**
- pale form less likely to breed / pass on genes 1
- (c) (i) pyramid of three layers of diminishing size
either way up 1
- three labels in food chain order
award 2 marks only if the pyramid is correctly labelled
accept trees / birch
accept (peppered) moth(s) / larvae 1
- (ii) some material is lost in waste from the birds 1
- peppered moth larvae do not eat all the leaves from the trees 1

Q10.

(a)



if more than one box is ticked award no mark

1

(b) increasing / higher light / temperature

*ignore references to months other than February – April
do **not** accept mineral / ions increase*

1

more / increased photosynthesis

*for both marks there must be a reference to 'more' at least once (e.g. 'more light for photosynthesis' gains 2 marks)
allow 1 mark for reference to light **and** photosynthesis without an idea of 'more'*

1

(c) increase due to increase in plant plankton / food

ignore references to months other than April – July

1

decrease due to fall in plant plankton / food **or** decrease as eaten by (basking) sharks

allow decrease as eaten by predators / animals / fish

1

(d) fall due to use / intake by plant (plankton)

*ignore ref to no change section of graph
for fall allow March / April
ignore May / February*

1

increase due to decay / decomposition / breakdown

*for increase allow any month in range August to November
ignore December*

1

of dead (plant / animal) plankton

allow of dead organisms / waste

1

[8]

Q11.

(a) C

1

- (b) B 1
- (c) E 1
- (d) D 1
- (e) F 1
- [5]**

Q12.

- (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 1
- allow converse referring to conifers*

- (ii) Wales has more conifers and / but more grey squirrels **or** Wales has less broadleaf and / but more grey squirrels 1
- allow converse for red squirrels*

- (c) any **three** from: *answers must be comparative they = grey squirrels*

grey squirrels *allow converse arguments for red squirrels*

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

3 **[7]**

Q13.

- (a) brown (colour) 1
- (b) (long) ears 1
- (c) (long) horns 1
- (d) (white) ring 1

[4]

Q14.

- (a) (soft) body parts / other parts / named parts
accept flesh 1

decayed / decomposed / rotted / eaten

or

bones do not decay / decompose / rot / get eaten

ignore disintegrated / dissolved

ignore microorganisms 1

- (b) any **one** aquatic feature from: eg 1
- streamlined body shape
 - long tail
 - eyes on top of head
 - scales
 - fins / paddles / flippers / webbed feet
ignore gills

any **one** terrestrial feature from:

- (front) legs / limbs / hands
 - could lift front end upwards
ignore feet
accept for 2 marks eg fin / flipper can be used for walking
or fins like legs
- 1

[4]

Q15.

(a) (reduced) competition

ignore fighting

1

for any **one** from:

- light
ignore Sun
- water
- nutrients / ions / salts / minerals
ignore food
- space
allow less overcrowding
- colonise new areas

1

(b) hooks

allow spines

1

attach to animals / human clothing / animals carry fruits long distances

ignore wind dispersal

1

[4]

Q16.

any **three** from:

ignore references to carbon cycle

accept digested / decomposed / broken down / rotted for decay throughout

ignore eating

- dead leaves / flowers / bluebells are decayed
- idea that microorganisms do the decaying
accept microbes / bacteria / fungi / mould / decomposers for microorganisms
- minerals / ions / nutrients / named released (by decay / microorganisms)
***not** mineral ions unqualified*
- (released) into soil **or** minerals / ions / nutrients taken up / in by (bluebell) roots (next year)

look for idea that minerals / ions / nutrients are in soil (eg released into soil or taken up from soil)

3

[3]

Q17.

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1-2 marks)

There is at least one example of an adaptation of either an animal **or** a plant. However it may not be clear how the adaptation helps the organism to avoid being eaten.

Level 2 (3-4 marks)

There is a description of an adaptation of at least one animal **and** at least one plant. It is clear how at least one of these adaptations helps the organism to avoid being eaten.

Level 3 (5-6 marks)

There are clear and detailed descriptions of a range of adaptations of named animals **and** named plants. It is clear how most of these adaptations help the organisms to avoid being eaten.

examples of clear and detailed biology points made in response:

- **camouflage** – the method of camouflage should be described plus a statement that the predator is less likely to see the prey
- **mimicry / warning colouration** – the method should be described plus a statement that the predator is likely to confuse the prey with e.g. a poisonous organism
- **thorns / prickles / spines / horns** – a statement that these are sharp and are likely to hurt a predator
- **long limbs / streamlining** – a statement that these increase speed and make it more likely that prey will outrun predator
- **bad taste / poison** – a statement that predator will find this unpleasant and 'spit out' prey / not attack same prey again
- **large ears / position of eyes** – a statement that predators will be detected earlier so the prey can escape sooner

[6]

Q18.

(a) *answer to be marked as a whole*

has thorns / prickles / points
accept sharp points

1

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

- 1
- (b) *answer to be marked as a whole*
- camouflaged / looks like twig / disguised
allow blends in
ignore too small to see
- 1
- (animal) cannot **see / detect** / recognise it
allow animal does not eat twigs
only accept prevents animal eating it if qualified by 'seeing'
 or 'wrong food'
- 1
- (c) *answer to be marked as a whole*
- red / colour
- 1
- warns that insect might be poisonous / dangerous
allow inedible / tastes bad
- 1
- [6]

Q19.

- there are no / few predators of the lionfish
or spines protect lionfish from predation
allow warning colouration / poisonous
- or** no / fewer disease organisms
- 1
- predators / prey in Atlantic do not recognise lionfish
or not fished by humans
allow high reproduction
- 1
- also there is abundant food in Atlantic
or there is no / less competition in Atlantic
ignore adaptation to new environment
- 1
- [3]

Q20.

- (a) large area
allow thin / large / big / flat / light
allow adaptations that cannot be seen eg internal air spaces
- 1
- (b) (shape means that) snow falls off
- 1

- (c) protect / stop it being eaten 1
- (d) stores/ absorbs water (from other parts of the plant)
ignore absorbs water from soil / air
ignore nutrients 1

[4]

Q21.

- (a) any **two** from:
ignore size of dish
- colour of dish **or** all dishes black
 - (same) amount of each seed
 - position of dishes **or** all dishes in same place / garden
ignore wood
 - time observed / visited / left 2
- (b) sunflower 1
- (c) (i) (No)
 named seed does not fit pattern
or
 millet / safflower / corn eaten a lot but have little fat
or
 the seed with the highest percentage eaten has least fat
accept converse 1
- (ii) *allow separate references to sunflower and niger*
 table 1 mark
- highest number of visitors **or** large range of visitors
allow most popular 1
- table 2 mark
- high percentage eaten
or
 contain high fat for energy / insulation

allow most eaten

1

[6]

Q22.

(a) (i) increased water uptake

ignore nutrients / food

allow quicker water uptake

allow collects water over larger area

1

(after) rain

accept ideas in terms of more successful competitor

1

(ii) water storage **or** stability **or** safety from predators

ignore absorption of water from soil

1

(b) reduces water loss / evaporation

accept reduces transpiration

allow stops water loss

1

wax protects plant **or** reflects heat **or** keeps plant cool **or** unpalatable

ignore reflects light

1

folding reduces surface area **or** folding reduces warming

*accept enclosed stomata **or** less exposure of stomata **or***

*increased humidity **or** less water concentration gradient*

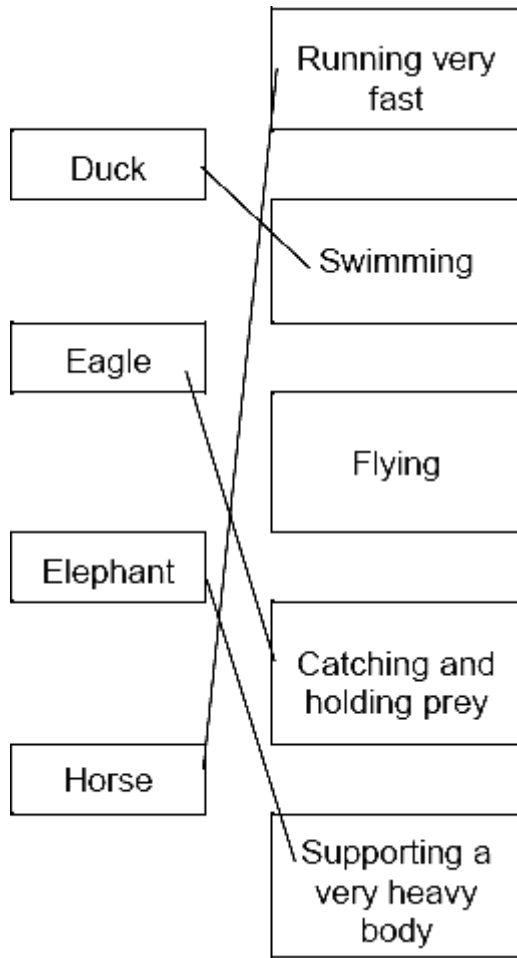
allow prevents burning

ignore less likely to be damaged

1

[6]

Q23.



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

[4]

Q24.

(a) any **two** from:

- food / feeding
ignore water
- mates / mating
- territory / space / land / shelter / nesting sites
ignore homes / place to live / habitat / resources
- status (within group)

2

- (b) (i) rises to 1480 to 1500
or rises by 880 to 900
or rises until 1993

ignore incorrect figures if 1993 given

1

falls to 400 to 440 **or** falls by 1040 to 1100

*if neither mark gained then allow 1 mark for rise followed by fall **or** fell by 160 to 200*

1

(ii) rises because: -

less competition from mule deer

or mule deer population falling

or fewer mule deer

ignore reference to food / breeding

ignore reference to predation / disease

1

falls because: -

more competition from mule deer

or mule deer population rising

or more mule deer

ignore more / less suited to environment

if neither mark gained then correct reference to competition gains 1 mark

1

[6]

Q25.

(a) camouflage / less visible

ignore insulation

1

(b) insulates / keeps warm

allow keeps out cold

ignore camouflage

1

(c) prey can't hear it / help catch prey / cannot hear it so isn't scared away

ignore predation on owl

1

(d) catching / eating / killing prey / perching / defence

1

[4]

Q26.

(a) any **two** from:

- shorter distance between samples

ignore repeat investigation / measurements

- sample to greater height
 - specify the size of each site
ignore longer transect 1
- (b) (i) Parmelia 1
- (ii) Evernia 1
- (c) any **two** from:
- Lecanora does not extend over whole range of transect / does not grow everywhere / does not grow in town centre / does not grow in countryside
 - Lecanora grows in a range of sulfur dioxide concentrations **or** Lecanora only grows in limited range of sulfur dioxide concentrations **or** Lecanora lives over large range of sulfur dioxide concentrations
 - other factors eg different pollutant might also influence growth of Lecanora
 - sulfur dioxide / pollutant concentration was not measured
ignore Lecanora does not give accurate measure of sulfur dioxide concentration
 - amount of Lecanora not measured 2

[5]

Q27.

1 mark for each adaptation and 1 mark for its correct **linked** advantage

fur / long hair / thick coat (1)

for insulation / reduces heat loss (1)

allow keeps warm for insulation point

large body / large mass / small (1) SA:V ratio

ignore layer of fat

retains heat / loses less heat (1)

ignore keeps warm

short legs (1)

reject short (height) / small (height)

reduces surface area / heat loss (1)

ignore keeps warm for this point

small ears (1)

reduces surface area / heat loss (1)

ignore keeps warm for this point

horns (1)

defence (1)

large shoulders (1)

to move through snow (1)

[4]

Q28.

(a) digging /getting to insects

1

(b) catching insects / food / insects
stick to the tongue

1

(c) hear insects / predators

1

(d) stop soil / dust / insects getting in

1

[4]

Q29.

(a) (i) quadrat / grid

allow suitable description in a(i) or a(ii)

allow quadrant

1

(ii) any **two** from:

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

2

(iii) the nearer to the road, the more (plantain) plants

accept the more dead nettles the less plantains

1

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

- grow better / survive away from road
- sensitive to pollutant / named pollutant / dust / fumes
ignore carbon dioxide as pollutant

- (roadside) weedkillers
- trampling /damage / turbulence
- grass cutting
- competition
- aspect eg hillier

or

give **one** mark for a factor and **one** mark for its effect eg

dust (from road) (1)

reduces photosynthesis (1)

or

'loses' in competition (1)

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

ignore food for plants

2

(ii) any **two** factors eg

ignore distribution

- can withstand pollution
allow grows better in polluted air
ignore ?prefer' pollution
- competition
- aspect eg flat

or

give **one** mark for a factor and

one mark for its effect eg

use carbon dioxide (from traffic) (1)

enhances photosynthesis (1)

or

'wins' in competition (1)

ignore food for plants

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

2

[8]

Q30.

(a) any **two** from:

- streamlined / smooth
allow description eg long and thin ignore slimy / oily skin unless qualified
- flippers
*allow fins **or** webbed feet*
- flattened / long / large / powerful tail
tail must be qualified to gain credit

2

(b) **1** mark for each adaptation and **1** mark for its correct linked advantage

correct advantage mark can be awarded if adaptation is attempted but not awarded the mark

eg

fat / blubber (1)

ignore skin / fur

insulates (1)

allow keeps warm

or

large mass to area ratio **or** small area to mass ratio (1)

ignore large body unqualified

allow volume for mass

heat loss reduced (1)

ignore keeps warm

2

[4]

Q31.

(a) protection / defence

*ignore insulation **or** rolls into a ball*

ignore camouflage

1

from predators / from being attacked / from being eaten

1

(b) looks like snake / looks scary

1

deters predators **or** has large eyes to spot predator **or** camouflage **or** warning colouration from predator or prey

allow two separate adaptations for 2 marks

- | | |
|--|---|
| (c) (i) natural selection | 1 |
| (ii) Darwin | 1 |
| (iii) simple life forms | 1 |
| (d) believe that God created all organisms or humans there from the beginning | 1 |

[8]

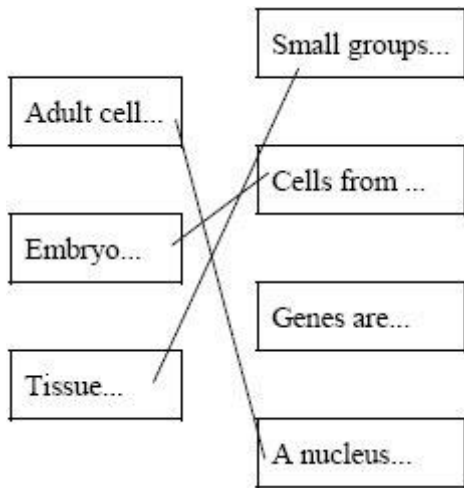
Q32.

- | | |
|--|---|
| (a) variation / mutation | 1 |
| individuals with characteristics most suited to environment survive | |
| <i>allow survival of the fittest</i> | 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]

Q33.

- | | |
|---|---|
| (a) killed by poachers / killed for tusks | 1 |
| less trees / leaves to eat | |
| <i>ignore feed on lots of leaves</i> | 1 |
| land available disappearing | 1 |
| (b) | |



all three correct = 3 marks
two correct = 2 marks
one correct = 1 mark
extra line from a statement cancels the mark

max 3

[6]

Q34.

- (a) streamlined / aerodynamic / swept-back / arrow-shaped / dart-shaped wings / tail

allow pointed / curved wings
ignore pointed tail / beak

OR

large / long wings

ignore large tail

1

- (b) no / fewer insects / food (in winter)

*allow **too** cold*
ignore not adapted to cold
ignore day length

1

- (c) (i) any **two** from

- feed / hunt at different heights **or** swifts feed higher up
- feed / hunt at different times **or** swifts feed at night
- arrive / depart at different times

2

- (ii) nesting sites / territory / habitat

allow homes / space

*ignore food unqualified
allow well qualified food answers
eg insects / food near the ground*

or

insects / food when it's light

or

insects / food between early May and early August

1

[5]

Q35.

- (a) long hind legs / muscular hind legs / bent hind legs

accept powerful hind legs

accept back legs act as spring

1

- (b) colour / markings warns predators not to eat it

allow animals learn not to eat them

ignore camouflage

1

[2]

Q1.

Copper compounds are found in water that has drained through ash from power stations. Invertebrate animals are used to monitor the concentration of copper compounds in water. First, scientists must find out which invertebrate animals can survive in a range of concentrations of copper compounds.

This is how the procedure is carried out.

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

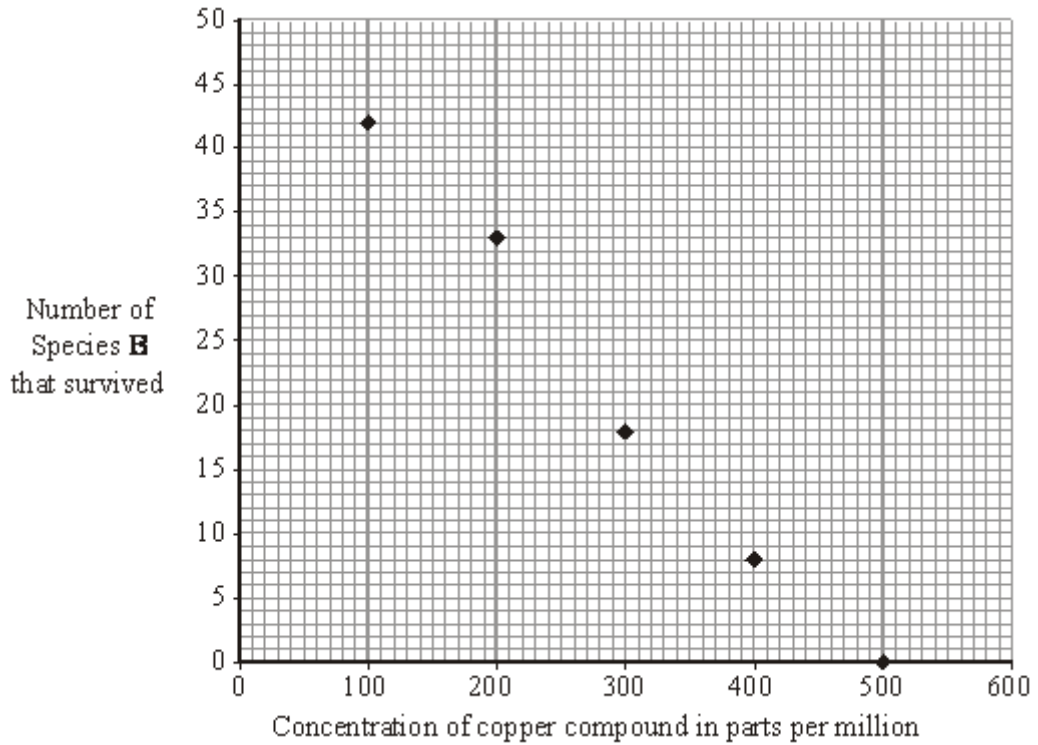
- (a) Give **two** variables that should be controlled in this investigation so that the results are valid.

1. _____

2. _____

(2)

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

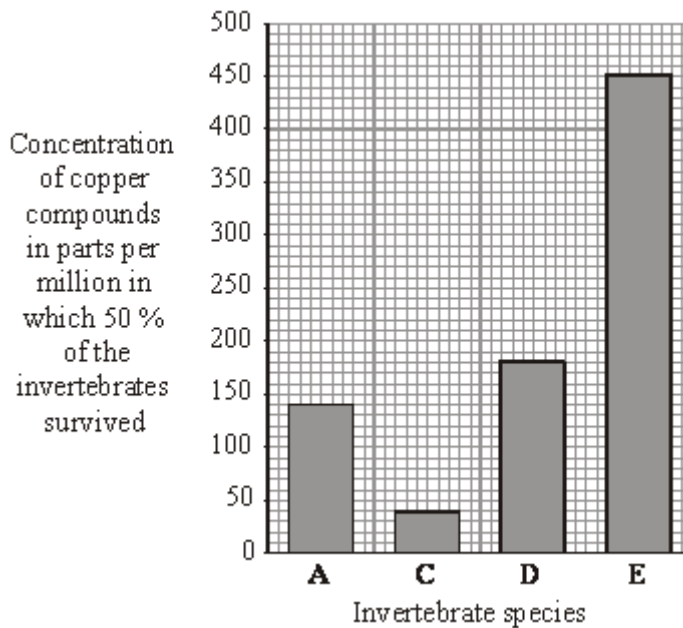


Use the graph to find the concentration of copper compounds in which 50% of Species **B** survived. To obtain full marks you must show clearly on the graph how you obtained your answer.

Concentration _____ parts per million

(2)

- (c) The graph below shows the results of the tests on the other four invertebrate species.



- (i) Which species, **A**, **C**, **D** or **E**, is most sensitive to the concentration of copper in the water?

Give the reason for your answer.

(1)

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

Suggest **one** explanation for this.

(2)

(Total 7 marks)

Q2.

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.

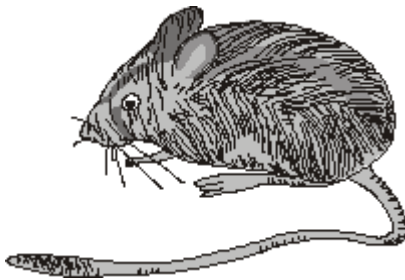
(2)

(Total 4 marks)

Q3.

The drawing shows a kangaroo rat.

This rat lives in hot, dry deserts.



- (a) Explain how each of the following features helps the kangaroo rat to survive in a hot, dry desert.

- (i) It does not produce urine.

(1)

- (ii) It lives in a burrow during the day, but comes out at night to search for food.

(1)

(iii) Its feet and its tail each have a large surface area.

(1)

(b) The kangaroo rat does **not** sweat.

Explain why **not** sweating could be dangerous for the animal.

(1)
(Total 4 marks)

Q4.

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

(a) The photograph shows an arctic fox.



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.



The antelope is prey to large cats such as cheetah.

Suggest **two** adaptations that help this antelope to avoid being killed by predators. Explain how each adaptation helps the antelope to avoid being killed by predators.

Adaptation 1 _____

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

Adaptation 2 _____

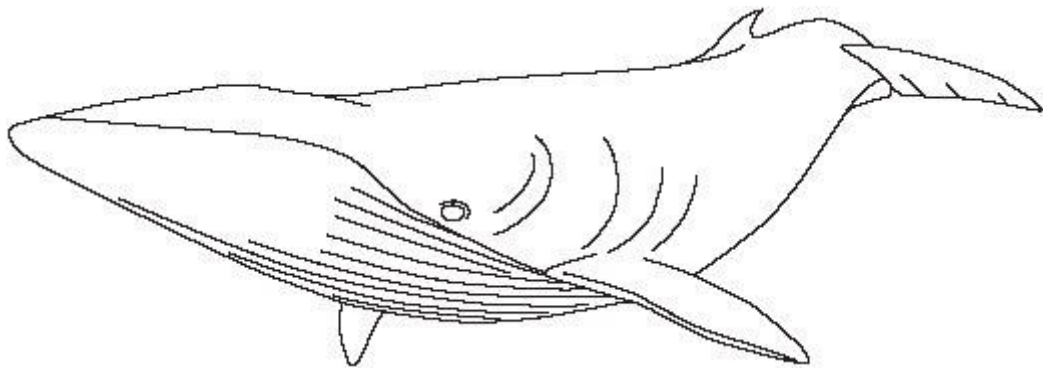
How this adaptation helps the antelope to avoid being killed by predators.

(4)
(Total 8 marks)

Q5.

(a) **Figure 1** shows a minke whale. Whales live in the sea.

Figure 1



Write down **two** ways in which the body of the whale is adapted for swimming.

1. _____

2. _____

(2)

(b) **Figure 2** shows the skeleton of a minke whale.

Figure 2

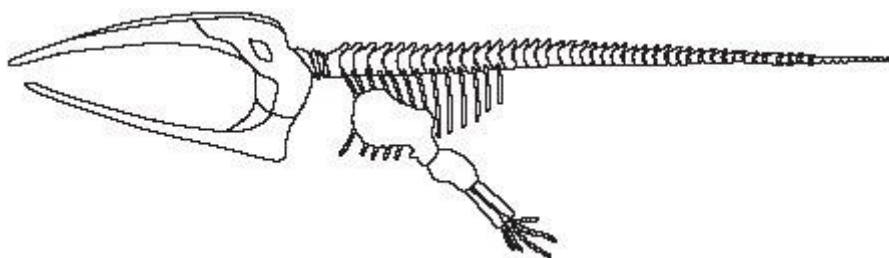
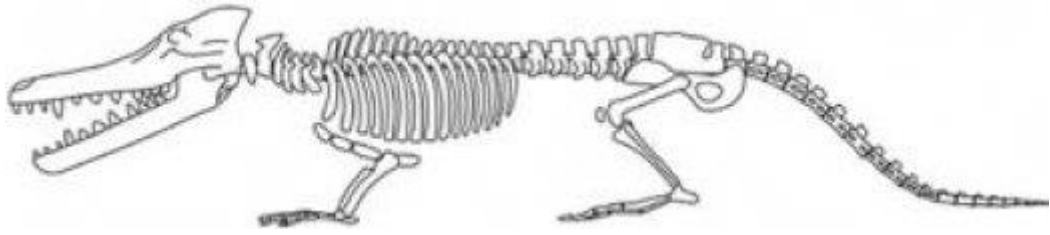


Figure 3 shows the fossil skeleton of an extinct whale.

Figure 3



Hans G Thewissen/ The Thewissen Lab

- (i) Apart from size, give **two** differences between the skeleton of the minke whale and the fossil skeleton of the extinct whale.

1. _____

2. _____

(2)

- (ii) In each of the sentences below, draw a ring around the correct answer.

Life on Earth first developed more than three

billion

million

thousand

years ago.

Fossils

disprove

give evidence for

prove

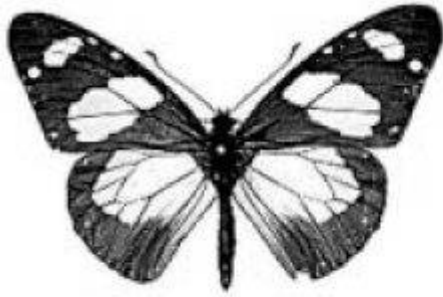
the theory of evolution.

(2)

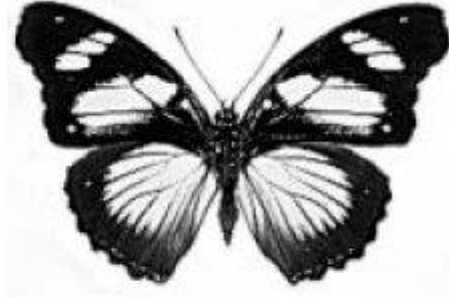
(Total 6 marks)

Q6.

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*.

(3)

(Total 5 marks)

Q7.

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.

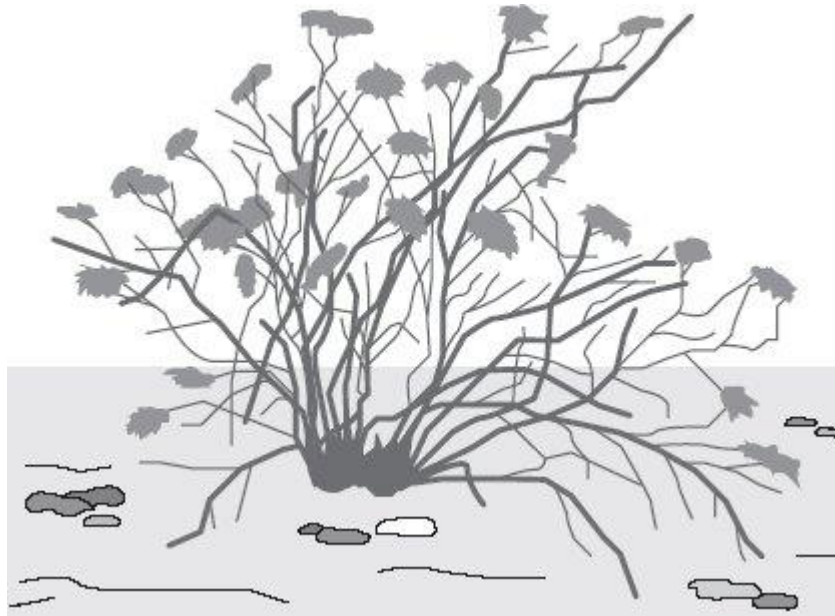
1. _____

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.



The katydid is preyed on by birds.

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

(1)
(Total 4 marks)

Q8.

Invertebrate animals are used to monitor pollution in streams. The photograph shows scientists collecting a sample of invertebrates from a stream.



Reproduced with the permission of John Graham

This is the method that they use.

- A 1 m² area of the bed of the stream is marked out.
- A net 1m wide is held by one person on the downstream side of the marked-out area.
- The other person uses their boots to gently move stones in this area of the stream bed. They do this for three minutes. This dislodges invertebrates which are then caught in the net.
- The invertebrates are then identified and counted.

(a) Name **two** control variables (variables which must be kept the same) in this investigation.

1. _____

2. _____

(2)

(b) Suggest **two** reasons why the results from a sample might not be accurate.

1. _____

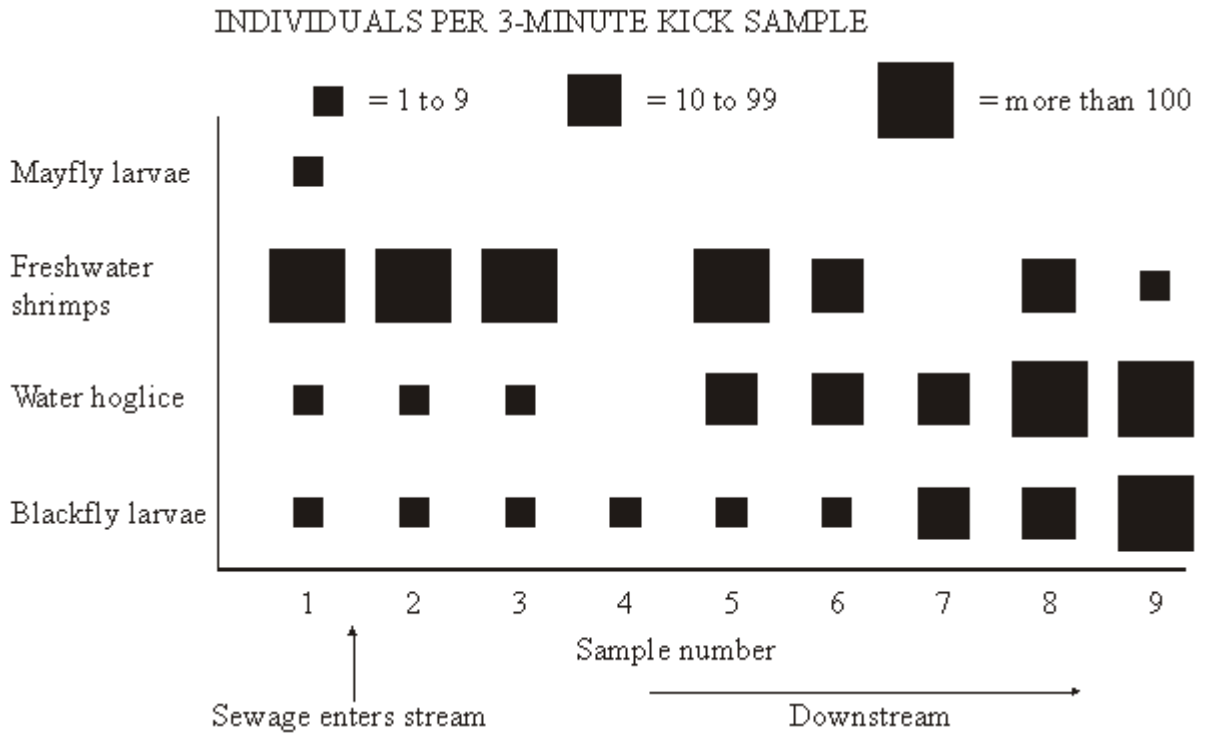
2. _____

(2)

The technique described above was used to investigate the effect of sewage on stream invertebrates.

- Sample 1 was taken upstream of the point where the sewage entered the stream.
- Samples 2–9 were taken at regular intervals downstream of the sewage inflow.

The graph shows the results.



- (c) What was the range of the number of blackfly larvae that could be found in sample 7?

_____ (1)

- (d) Describe, as fully as you can, how the number of water hoglice changed downstream from where sewage entered the stream.

_____ (2)

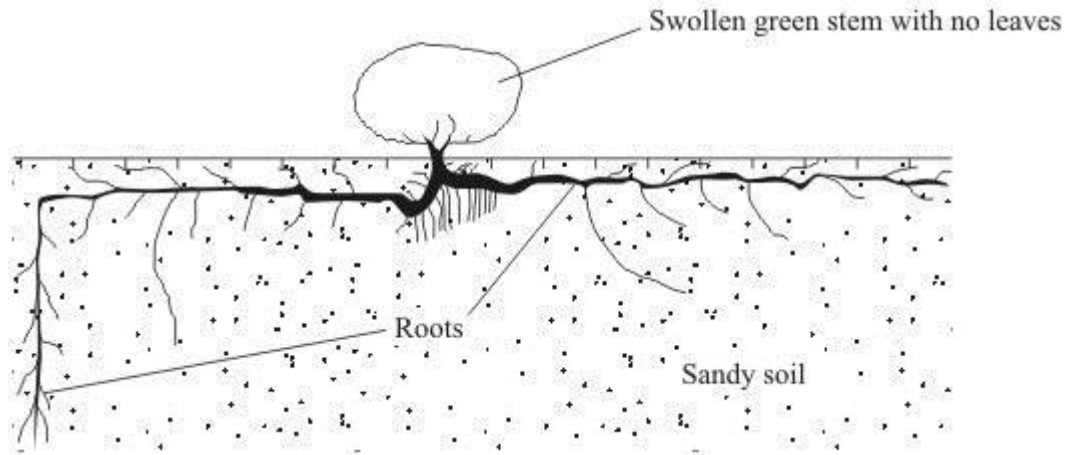
- (e) Which of the four invertebrates is the best indicator species for water which is **not** polluted by sewage?

Give the reason for your answer.

(2)
(Total 9 marks)

Q9.

The drawing shows a bean caper plant.



The bean caper plant lives in hot desert conditions.

Explain two ways in which the bean caper is adapted for life in a hot desert.

Adaptation 1 _____

How this adaptation helps the bean caper to survive

Adaptation 2 _____

How this adaptation helps the bean caper to survive

(Total 4 marks)

Q10.

The lynx is a wild cat which lives in Canada. The table shows the number of lynx trapped in a part of Canada in certain years.

Year	Number of lynx in thousands
1918	45
1920	25

1922	10
1924	20
1926	40
1928	50

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



- (a) Draw a graph of the data in the table. The first two points have been plotted for you. (2)
- (b) From your graph, predict how many lynx were trapped in 1925.
 _____ thousand (1)
- (c) Use the information to answer the following.
- (i) What would you expect to happen to the number of lynx trapped in 1930?
 Draw a ring around your answer.
- rise** **fall** **stay the same**
(1)
- (ii) Give a reason for your answer to part (c)(i).

(1)

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

(1)

(Total 6 marks)

Q11.

The table compares some features of a polar bear and the Malayan sun bear. The polar bear lives in the Arctic where the climate is cold. The Malayan sun bear lives in warm tropical forests.

	Polar bear	Malayan sun bear
Colour of fur	White	Black
Thickness of fur in cm	5	2
Thickness of fat layer under skin in cm	11	1
Surface area compared to body size	Low	High

Use information from the table to explain how the polar bear is better adapted than the Malayan sun bear for survival in arctic conditions.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

(Total 5 marks)

Q12.

A selective herbicide (a type of pesticide) can be used to kill weeds growing among crop plants.

The table shows the result of adding different amounts of a selective herbicide to a rice crop.

Herbicide added in kg per hectare	Amount of rice produced in tonnes per hectare	Percentage cover of weeds
0.0	50	85
1.7	70	32
3.4	76	24

(a) As more herbicide is applied, what happens to:

(i) the amount of rice produced;

(1)

(ii) the percentage cover of weeds?

(1)

(b) Suggest **two** reasons why rice does not grow well when there are a lot of weeds present.

1. _____

2. _____

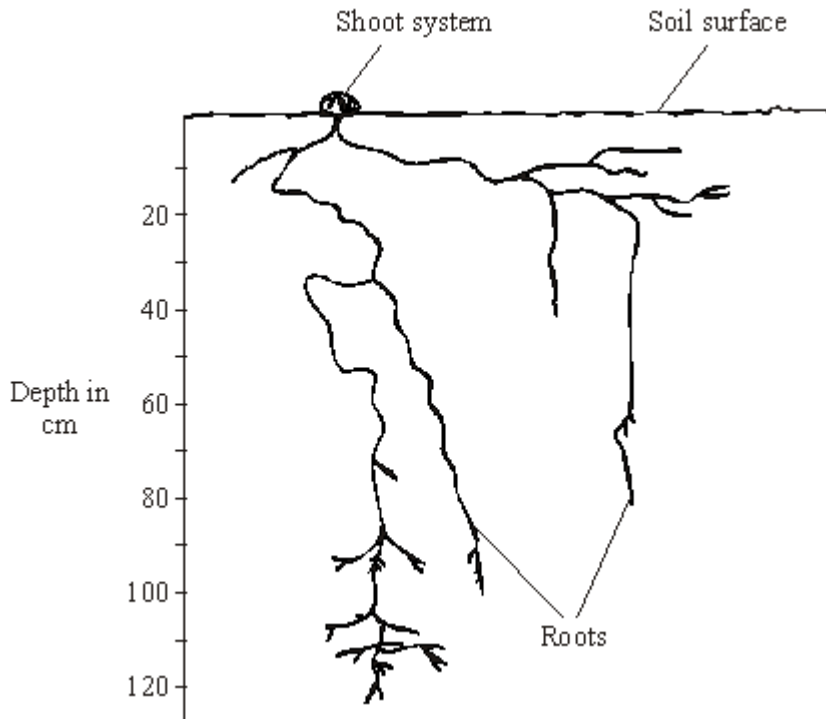
(2)

(c) Suggest **one** possible danger of spraying crops with pesticides.

(1)
(Total 5 marks)

Q13.

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. _____

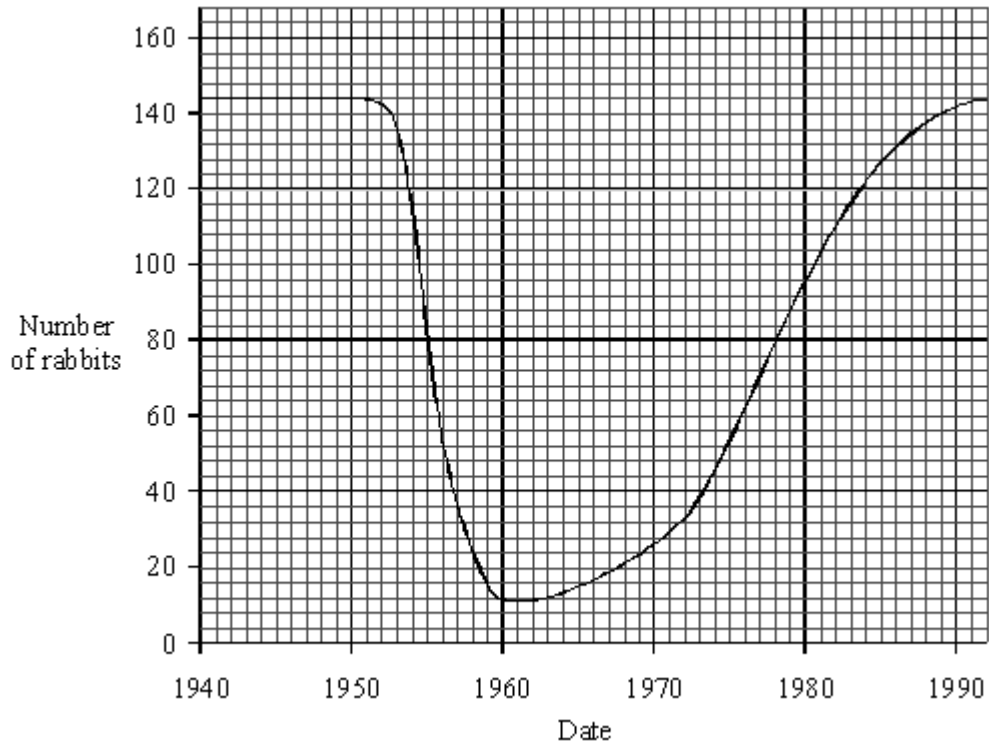
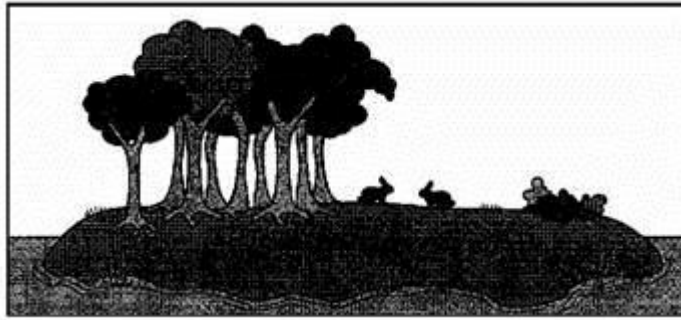
2. _____

3. _____

(Total 3 marks)

Q14.

A population of rabbits lived on a small island. The graph shows their population over the last 50 years.



- (a) (i) How many rabbits were there on the island in 1950?
-
- (1)
- (ii) Give **one** year when there were 88 rabbits on the island.
-
- (1)
- (b) (i) Calculate the decrease in rabbit population between 1950 and 1960.
-
- (1)
- (ii) Suggest a reason why the rabbit population fell in these years.
-
- (1)
- (c) The most rabbits on the island is always about 140. Suggest a reason for this.

(1)
(Total 5 marks)

Q15.

Animals and plants are adapted to live in their environment.

(a) Explain how these adaptations help animals keep warm in cold conditions.

(i) A thick fur coat

(2)

(ii) A thick layer of fat beneath the skin

(2)

(iii) A large body

(2)

(b) Lots of animals are *camouflaged*. What does *camouflaged* mean? Give **one** advantage of being *camouflaged*.

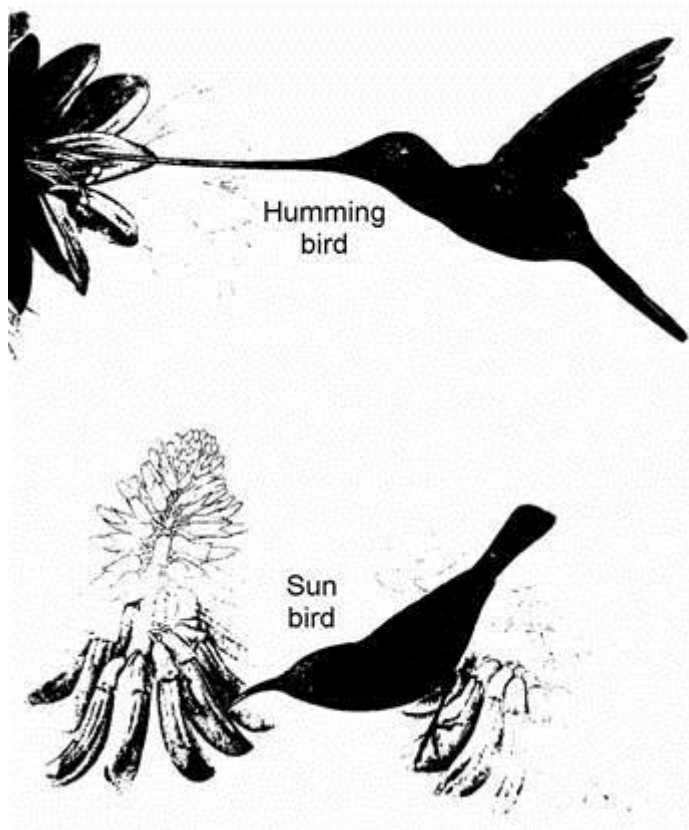
(2)

(c) Describe **two** different ways that plants could be adapted to survive in dry conditions like a desert.

(2)
(Total 10 marks)

Q16.

The drawings show a humming bird and a sun bird feeding.



Both of these birds feed on nectar which is a sugary liquid found inside flowers.

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

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

(2)

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

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

(2)
(Total 4 marks)

Q17.

The table below shows what some of the living things in a wood do at different times of the year.

Organism	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Oak tree												
Hazel (bush)												
Primrose (plant)												
Bluebell (plant)												
Squirrel (mammal)												
Owl (bird)												

	In leaf
	In flower
	Mating season
	Rearing young

Use information from the table to help you to answer the following questions.

- (i) For how many months are there leaves on the oak trees? _____ (1)
- (ii) There are no leaves on the oak tree for the whole of one season. Which season is this?
 _____ (1)
- (iii) Suggest **one** change in the environment which might cause oak trees to lose

their leaves.

(1)

- (iv) Bluebells live on the floor of the wood. Explain why it is an advantage to the bluebells to produce leaves in February rather than later in the year.

(2)

- (v) When do the owls mate? _____

(1)

- (vi) Explain **one** advantage to the owls of rearing their young in summer rather than in winter.

(1)

(Total 7 marks)

Q18.

- (a) One food chain in the wood is:

Hazel tree nuts → squirrels → owls

- (i) What does this food chain tell us?

(2)

- (ii) Which **one** of the organisms in the food chain is a producer?

(1)

- (iii) This year the hazel bushes have produced very few nuts.

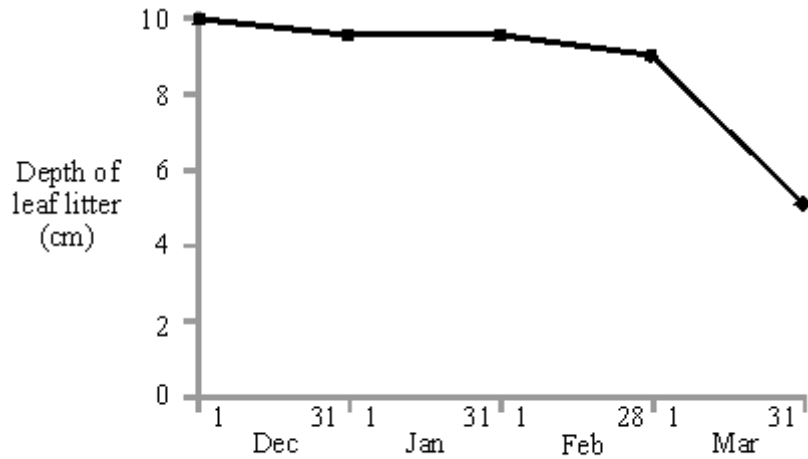
Explain, as fully as you can, how this might affect the populations of:

1. squirrels;

2. owls.

(4)

- (b) An area of the floor of the wood 1 m² was fenced off so that animals could not reach it. The graph below shows the depth of leaf litter (dead leaves) inside the fence over the next few months.



Explain, as fully as you can,

- (i) why the depth of the leaf litter decreased;

(1)

- (ii) how this decrease happened.

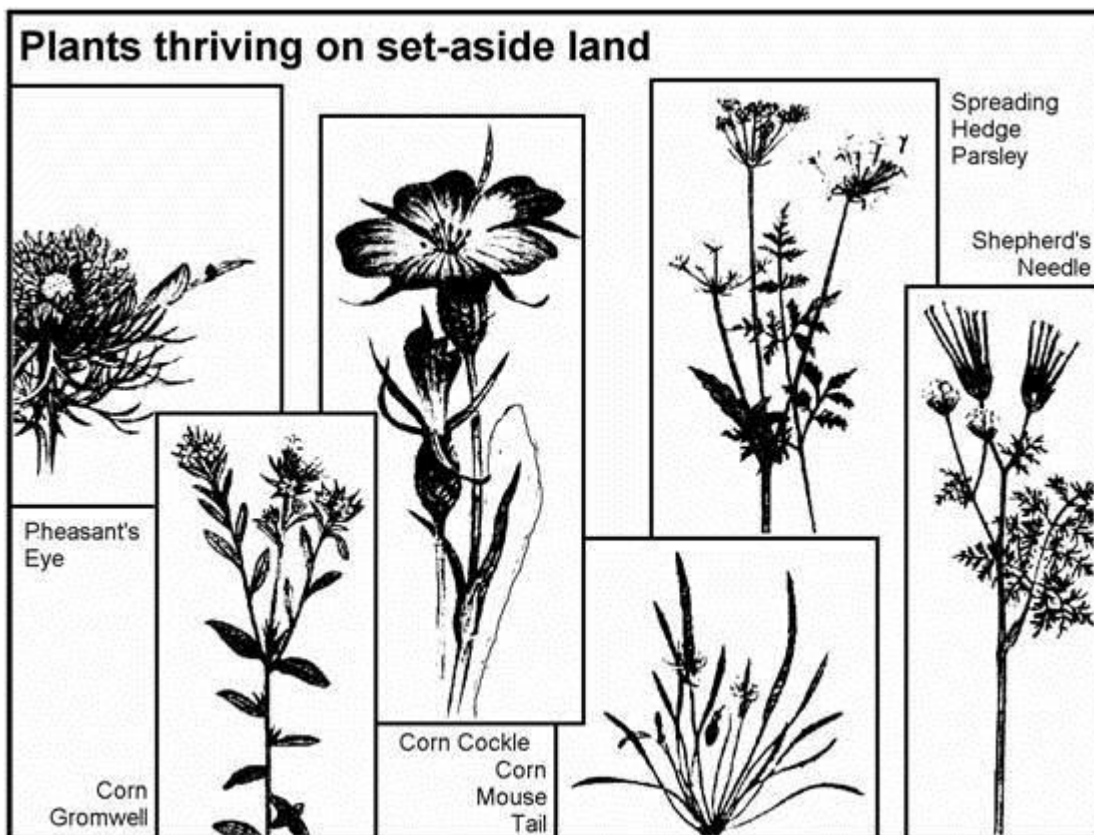
(1)

(iii) In which month does leaf litter disappear fastest? Explain why.

(2)

(Total 11 marks)

Q19.



The drawings and text for this question are based on an article from The Independent newspaper.

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

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

lightly tilled and cut once a year.

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

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

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

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

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

(4)

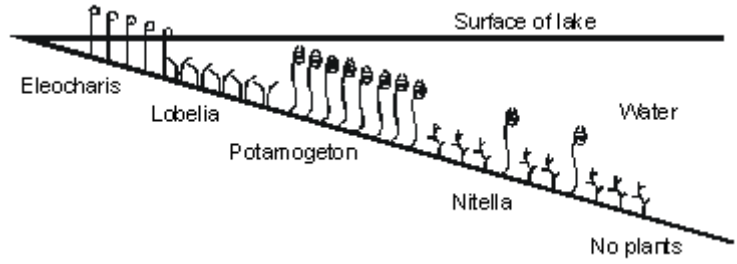
- (b) What would you recommend to ministers meeting to decide a policy involving rotational set-aside and permanent set-aside? Explain the reasons for your answer.

(4)

(Total 8 marks)

Q20.

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)

Q21.

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)

Q22.

Squirrels live mainly in woodland. There are two types of woodland in Great Britain: coniferous woodland containing trees such as Scots pine and Norway spruce, and broad-leaved woodland containing trees such as Hazel, Beech, Oak, Sycamore and Sweet chestnut.

The red squirrel is a native species, the grey squirrel was introduced at the beginning of this century. Since the introduction of the grey squirrel, the red squirrel has largely disappeared from broad-leaved forests in England.


- (a) Suggest **two** factors which might have caused the fall in the population of red squirrels.

1. _____

2. _____

(2)

- (b) The drawing gives information about the two types of squirrel.

RED ←		HOW THEY DIFFER	→ GREY		
Weight: ¾ lb	Appearance: tufted ears and chocolate coat in winter; chestnut in summer.		Weight: 1½ lb	Appearance: ears not tufted, silver-grey coat in winter, yellow-brown in summer	
Habitat: favours large coniferous forest.			Habitat: favours broadleaved woodland and can colonise hedgerows.		
The red has a shy, retiring nature and spends 70% of time in the forest canopy.			A natural showman and acrobat, the grey spends only 14% of time in the canopy.		
FOODS THE REDS LIKE... AND THOSE THEY DON'T					
Scots pine cone	Hazel nuts	Norway spruce cone	Beech mast	(Oak) acorns	Sycamore Sweet chestnut
					

Up to six times as many grey squirrels as red can populate broadleaved woodlands, while red squirrels can match the density of greys only in coniferous forests

Using **only** information given above, suggest **two** reasons why the population of grey squirrels has risen whereas the population of red squirrels has fallen.

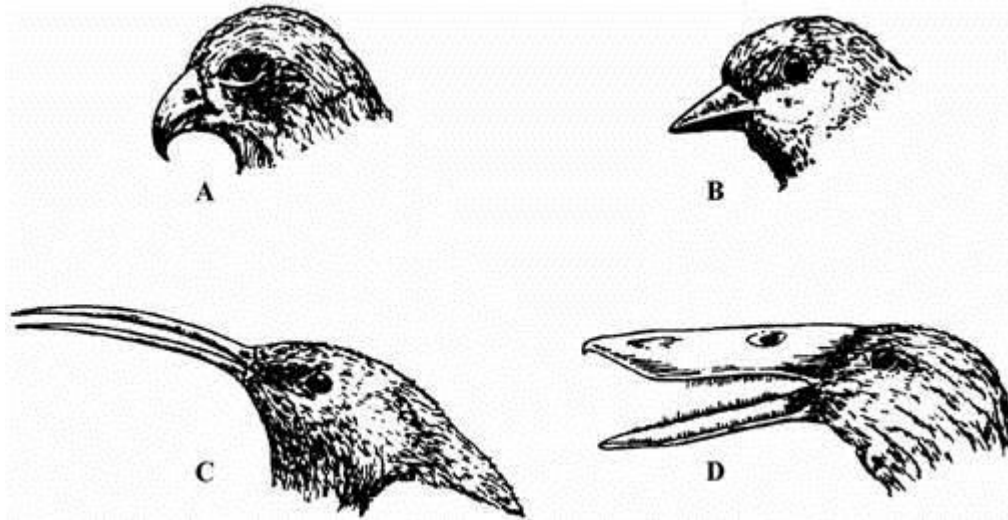
1. _____

2. _____

(2)
 (Total 4 marks)

Q23.

The drawings show the heads of four birds, not drawn to scale. The birds feed in different ways.



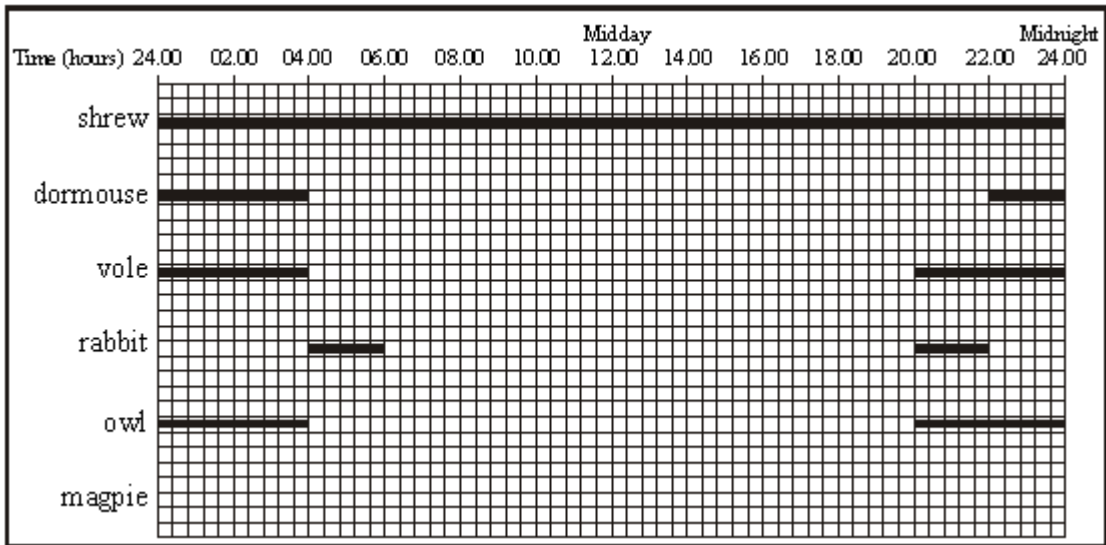
Which of the birds, A, B, C or D, is best adapted for:

- | | |
|--|-------|
| 1. tearing flesh | _____ |
| 2. finding insects in cracks in the ground | _____ |
| 3. crushing fruit | _____ |
| 4. sieving small animals from mud? | _____ |

(Total 4 marks)

Q24.

The chart is about some of the animals which live in a forest. It shows the time of day when they search for food.



(a) The dormouse searches for food from 22.00 until 04.00 hours.

When does the owl search for food? _____

(1)

(b) The magpie searches for food from 06.00 until 20.00 hours.

Add this information to the diagram.

(1)

(c) The vole searches for food only between 20.00 and 04.00 hours.

Suggest an explanation for this.

(2)

(Total 4 marks)

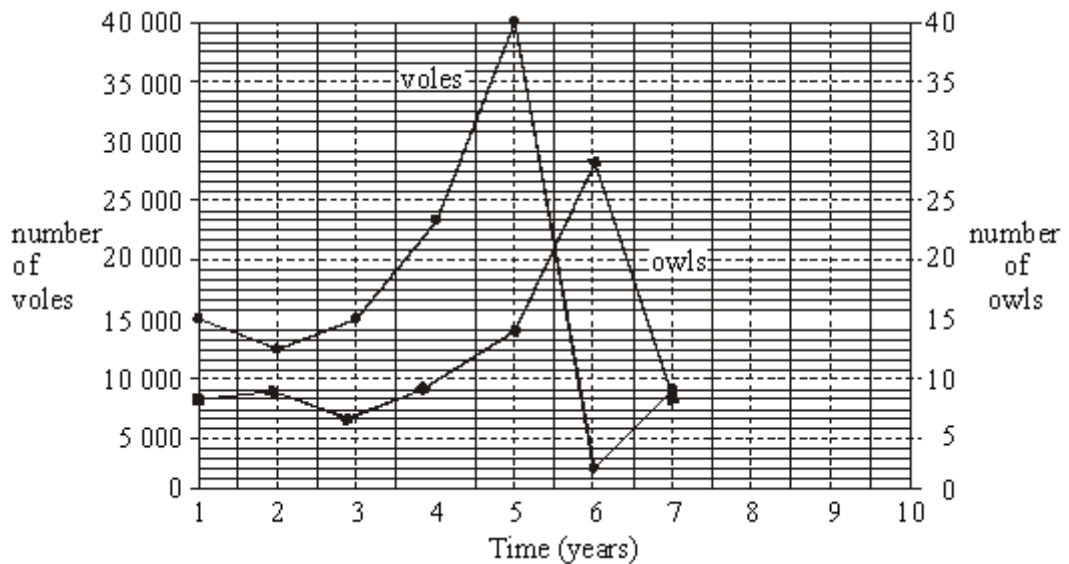
Q25.

The table shows the results of a ten-year study of the owls and voles in a forest.

YEAR	NUMBER OF VOLES (TO THE NEAREST THOUSAND)	NUMBER OF OWLS
1	15 000	8
2	12 000	9
3	15 000	7
4	23 000	9
5	40 000	14
6	2 000	28
7	9 000	8
8	19 000	9
9	10 000	14
10	8 000	16

The data for years 1 - 7 have been plotted on the grid below.

- (a) Complete the graph by plotting the data for years 8 - 10.



(2)

- (b) (i) What is the main factor which limits the size of the owl population?

(1)

- (ii) Suggest **two** reasons other than owl predation, for the large fall in the numbers of voles between years 5 and 6.

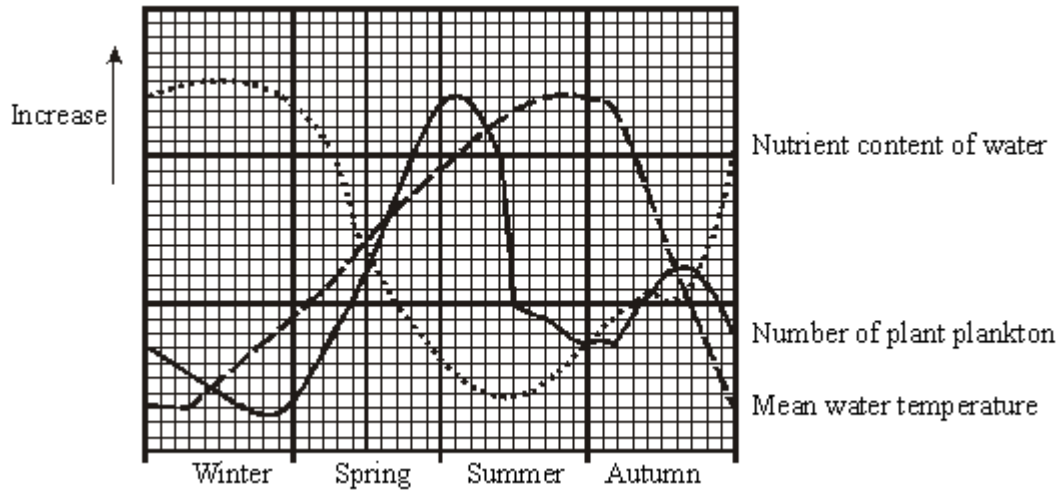
1. _____

2. _____

(2)
(Total 5 marks)

Q26.

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)

Q27.

The gemsbok is a large herbivore that lives in herds in desert areas of South Africa. Gemsboks feed on plants that are adapted to living in dry conditions. There are not many rivers, lakes or ponds that can provide drinking water for the animals. The desert areas are hot during the day but cool at night. As the air cools at night it becomes moist, and the plants absorb the moisture.



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

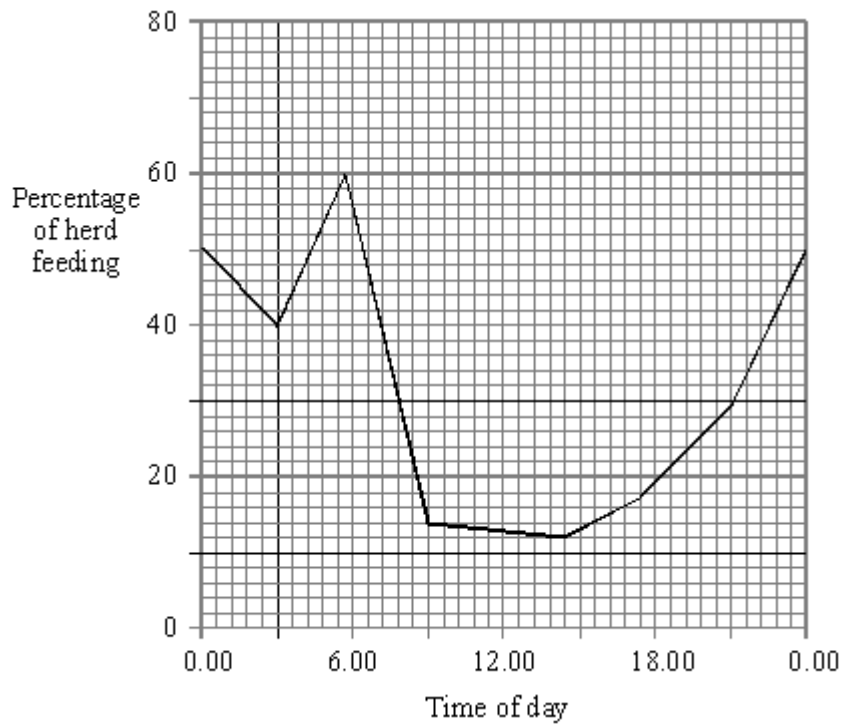
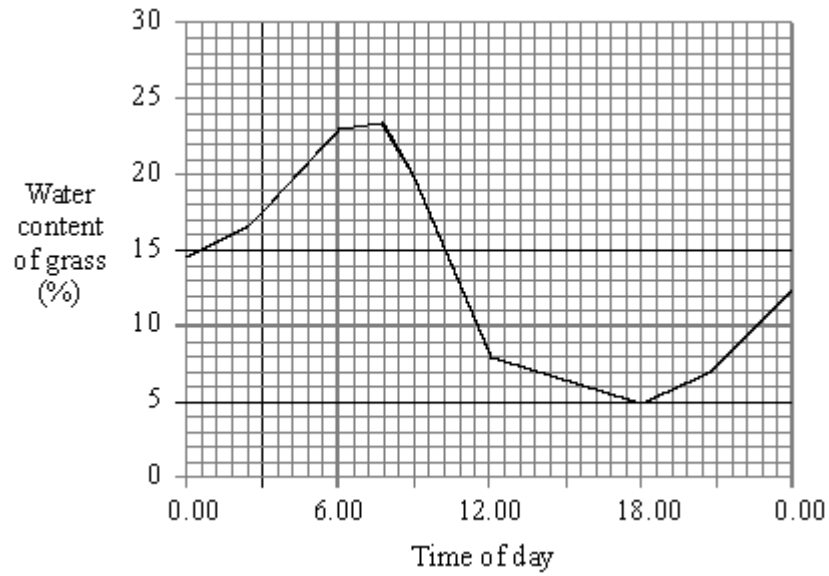
Use information from the drawing of the gemsbok to suggest **two** ways in which it could avoid being killed by lions.

1. _____

2. _____

(2)

- (b) The graphs show the water content of the desert grass and the times of day that the gemsboks feed.



- (i) Describe how the water content of the grass changes during the day.

(1)

- (ii) Suggest why the water content of the grass changes.

-
- (c) (i) Between which times of day are more than 25% of the herd feeding?
_____ and _____ (1)
- (ii) Suggest an advantage to the gemsbok of feeding mainly at these times.

_____ (2)
- (Total 7 marks)**

Q28.

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.

(Total 4 marks)

Q29.

Read the passage.



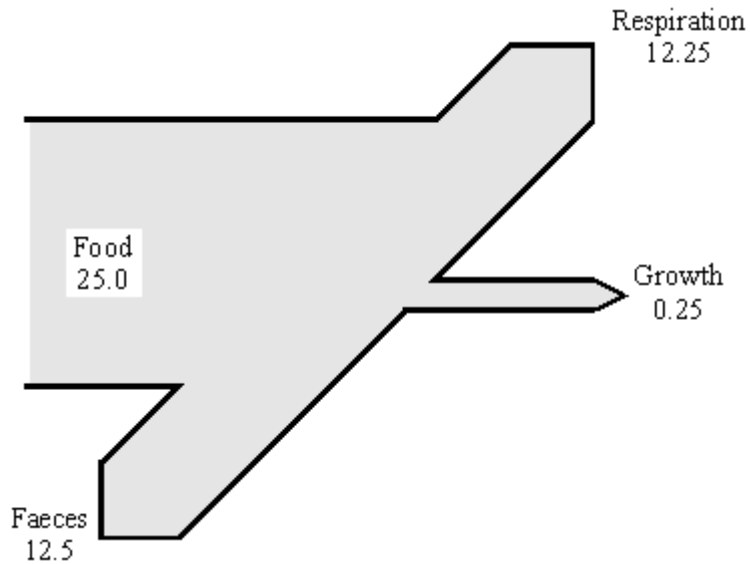
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The diagram shows the flow of energy through a koala.
The numbers show units of energy.



- (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. _____

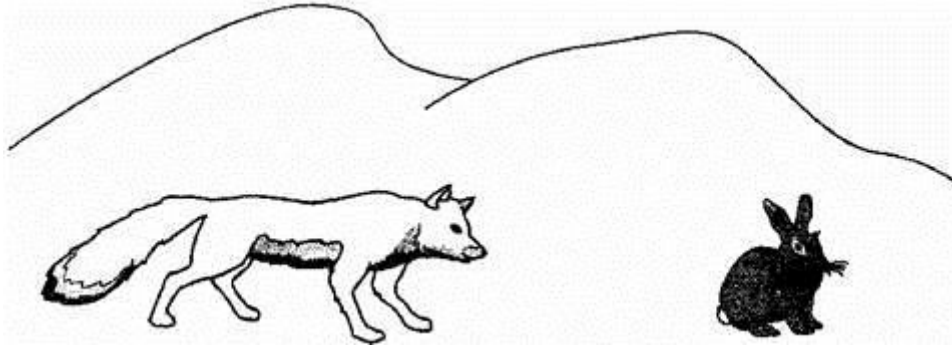
3. _____

(3)

(Total 5 marks)

Q30.

The Arctic fox is a predator that feeds mainly on small mammals. The Arctic fox is adapted to live in the cold conditions of the snow-covered Arctic.



The Arctic fox has thick, white fur.

Give **two** ways in which the fur helps the Arctic fox to survive.

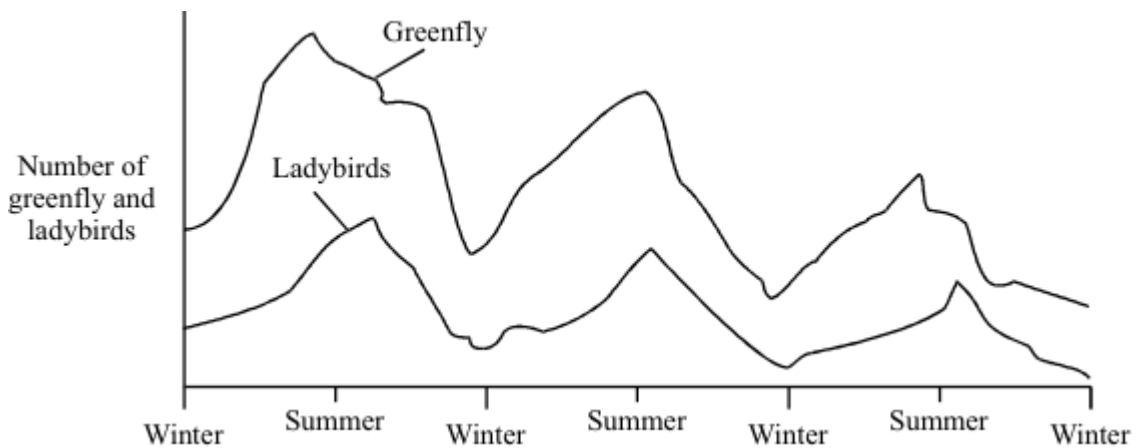
1. _____

2. _____

(Total 2 marks)

Q31.

Greenfly feed on rose bushes. Ladybirds (predators) feed on these greenfly. The graph shows how the population of greenfly and ladybirds in a garden change over a period of three years.



- (a) *To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

Describe what happened to the population of greenfly over the three years.

(3)

(b) Give **one** factor that limits the number of ladybirds.

(1)

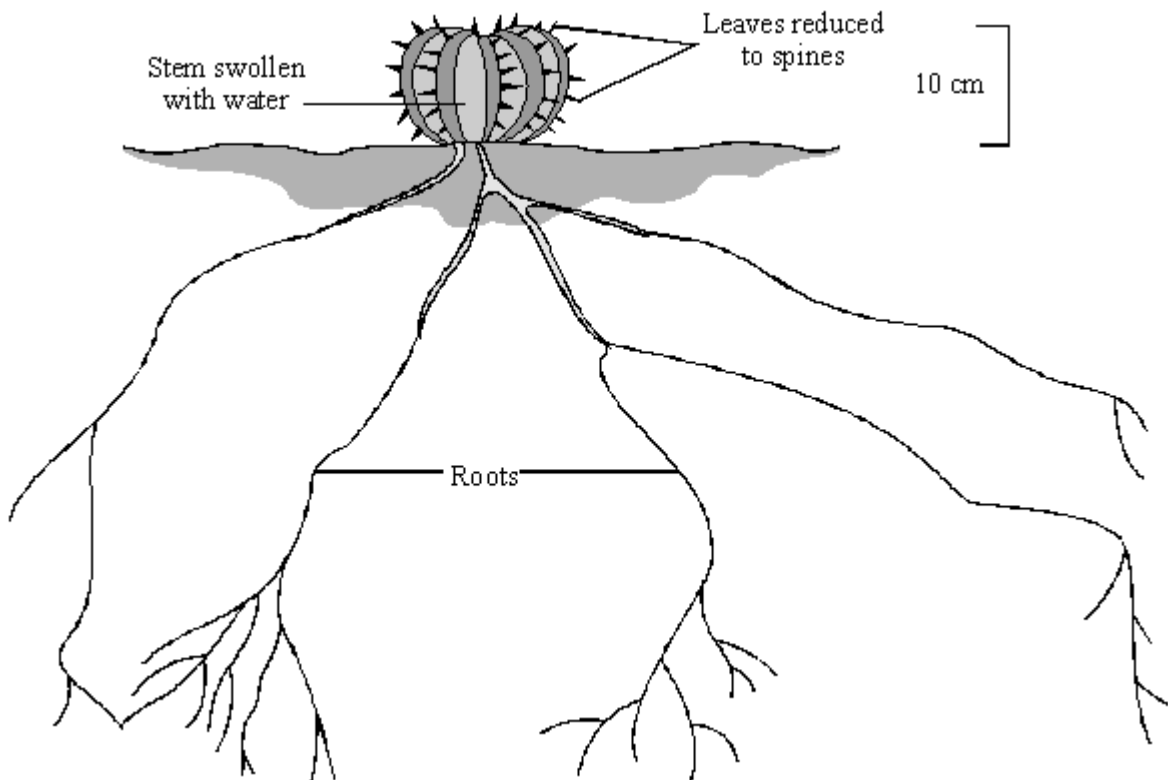
(Total 4 marks)

Q32.

The concentration of carbon dioxide in the Earth's atmosphere is rising.

The rise in carbon dioxide concentration may cause more of the Earth's surface to become desert.

The drawing shows a plant that is adapted to life in a hot, dry desert.



Suggest **two** ways in which the structure of the plant helps it to survive in a hot, dry desert.

1. _____

2. _____

(Total 2 marks)

Q33.

Camels can live in hot deserts.



Read the following information.

- A camel has big, flat feet.
- A camel's hump is where fat is stored.
- The fat from a camel's hump can be broken down to form carbon dioxide and water.
- A camel has no layer of fat under the skin.
- A camel can go at least two weeks without water.
- A camel can drink large amounts of water in one go.
- A camel has long eyelashes and long hair around the openings to its ears.

(a) Give **one** way that the camel is well adapted to living where there is sand.

(1)

(b) Suggest why the camel does **not** need a layer of fat under its skin.

(1)

(c) Give **two** reasons why the camel can go at least two weeks without drinking any

water.

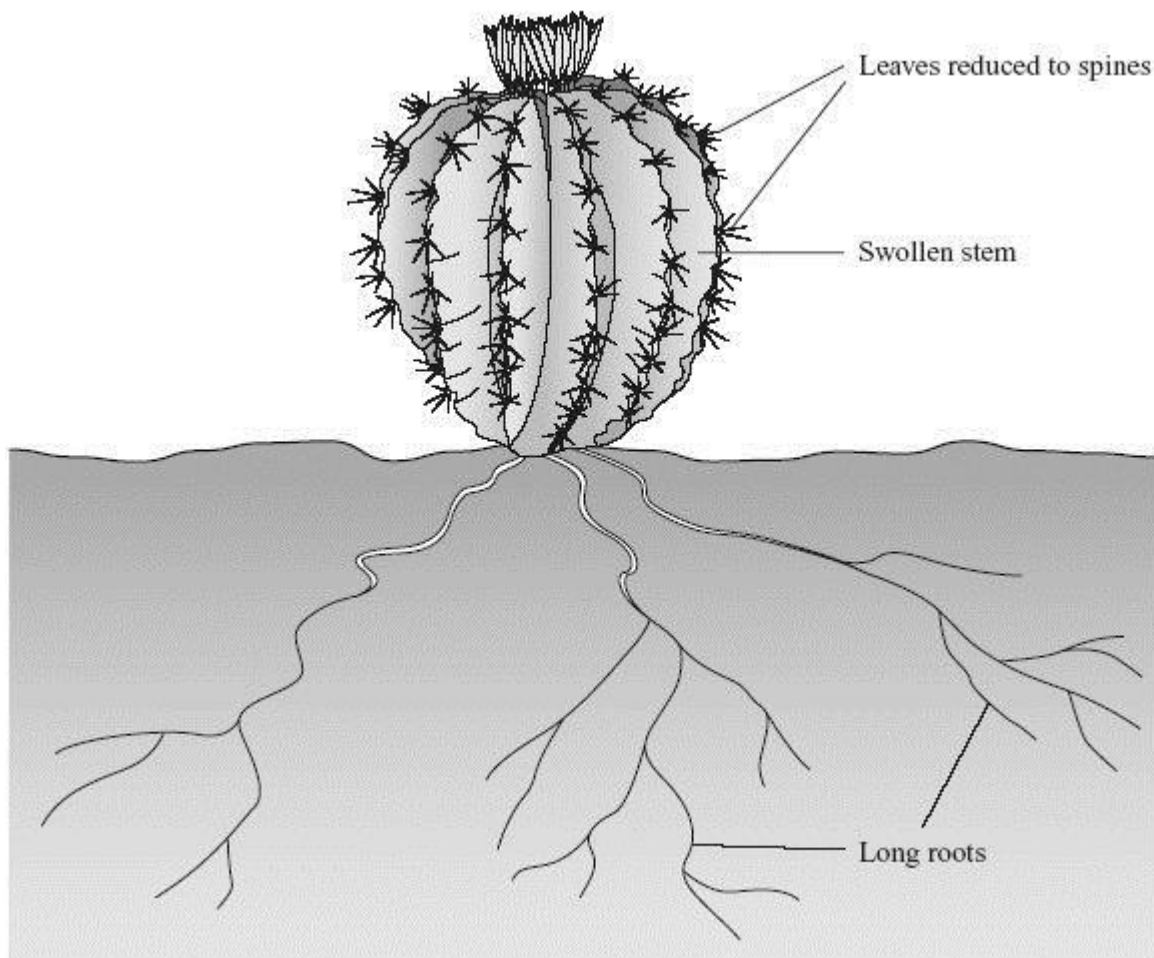
1. _____

2. _____

(2)
(Total 4 marks)

Q34.

The drawing shows a plant that is adapted to life in a hot, dry desert.



(a) Which labelled part of the plant helps it to get the water it needs?

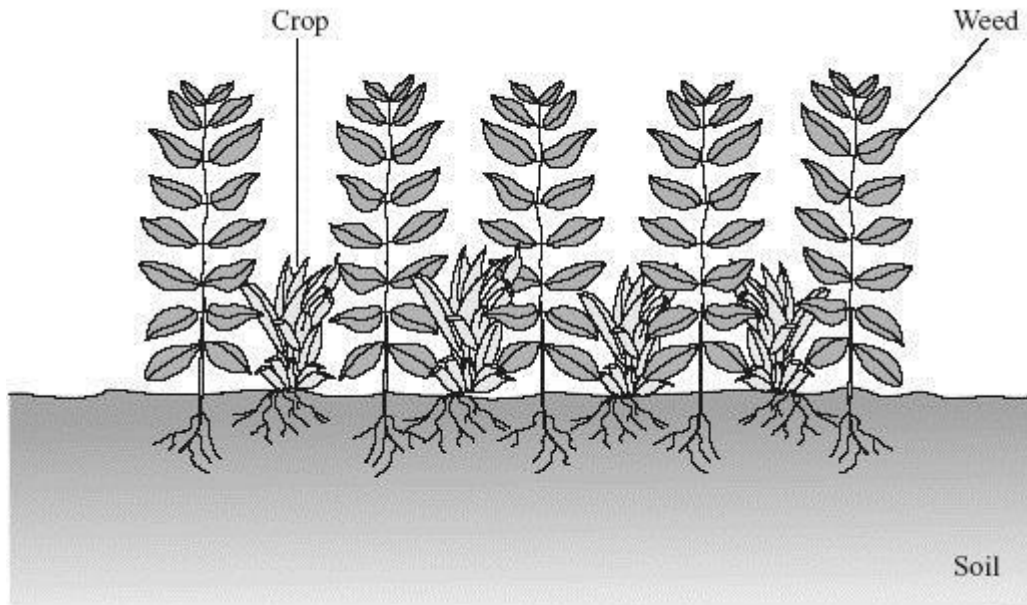
(1)

(b) The stem of the plant is covered by wax.
How does this help the plant to survive?

(1)
(Total 2 marks)

Q35.

Farmers need to get rid of weeds because they can stop crops growing well.



(a) Write down **three** things that crops and weeds compete for.

1. _____
2. _____
3. _____

(3)

(b) Complete this sentence by crossing out the **two** words that are wrong in the box.

Chemicals that are used to kill weeds are called

- | |
|-------------|
| fertilisers |
| herbicides |
| pesticides |

(1)
(Total 4 marks)

Mark schemes

Q1.

- (a) any **two** from: eg
- same volume of solution
do not allow same size of container
 - left for same length of time
 - same temperature
 - same oxygen
 - same pH
 - same number of invertebrates / animals
do not allow same number of species
 - same age / stage of invertebrates / animals
- 2
- (b) line of best fit / curve / point to point drawn going through 240-260 and 25
- 1
- correct interpolation to X axis
if no work on graph allow 250
- 1
- (c) (i) (C)
- 50% killed at lowest / low copper concentration
ignore least survivors
- 1
- (ii) any **two** from:
- involves counting
easy to count gains 2 marks
 - easy to do
 - invertebrates more sensitive
 - needs less / no apparatus
ignore more reliable / accurate
- 2

[7]

Q2.

- (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 from respiration

2

[4]

Q3.

(a) (i) conserves water owtte

1

- (ii) prevents overheating / keeps cool
allow cooler at night
allow safety from predators

1

- (iii) increases heat loss / cooling
allow prevents sinking into sand

1

(b) animal could overheat owtte

1

[4]

Q4.

(a) 1 mark for each adaptation and 1 mark for its correct linked advantage

- long / thick hair / fur (1)
for insulation (1)
allow keeps warm
- small ears (1)
for reduced heat loss (1)
- small feet (1)
for reduced heat loss (1)
ignore wide feet
ignore prevent sinking
- white fur / coat (1)
for camouflage / poor emitter (1)
- small SA/V ratio (1)
reduces heat loss (1)
- thick layer of fat (1)

insulates / keeps warm (1)

max 4

(b) 1 mark for each adaptation and 1 mark for its correct linked advantage

- horns (1)
for defence (1)
- long legs (1)
for speed / escape / vision (1)
- light colour (1)
for camouflage (1)
allow pattern
- eyes on side of head (1)
for wider field of vision (1)
- hooves (1)
for speed / escape (1)
- large ears (1)
to hear predators better (1)

max 4

[8]

Q5.

(a) any **two** from:

- streamlined / shape reduces friction / long and thin / smooth surface
OWTTE
- fins / flippers / tail / paddle
do not accept 'arms' or 'legs'
- structures that push against water

2

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

fossil has hind limb / legs / feet
it = minke
accept any valid comparison

fossil has more ribs / bones

fossil has teeth

fossil has curved spine

2

(ii) billion

1

give evidence for

1

[6]

Q6.

- (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]

Q7.

- (a) (i) any **two** from:

list principle

- light
ignore oxygen / food / sun
- water
- space
- nutrients / ions / minerals / named
- carbon dioxide / CO₂

2

- (ii) less competition for water

ignore space / light / food

or

more water / nutrients / minerals available

1

- (b) camouflage / same shape as leaf / looks like a leaf
allow 'blends in'
ignore colour

1

[4]

Q8.

- (a) any **two** from:
control variables from information given
- area of bed sampled
 - sampling time
 - size of net
 - kicking action
 - net position
- 2
- (b) any **two** from:
must be ideas related to a sample
- some animals not dislodged
ignore reliability etc
 - some animals missed / through / escaped net
 - invertebrates difficult to identify
 - invertebrates from outside area
- 2
- (c) 10 to 99 **or** 10 – 99 **or** 99 to 10 **or** 99 – 10
- 1
- (d) any **two** from:
- increased / goes up
allow increase implied from all data described
 - 0 at sample 4
 - to (more than) 100
- 2
- (e) mayfly
- 1
- because not found downstream of point where sewage enters stream
or only in the unpolluted water
- 1

[9]

Q9.

- adaptation and linked advantage eg
max 2 for 3 adaptations
- 2

- roots widespread / long (1)
to collect water from large area (1)
ignore large roots
accept to collect more water
- some roots deep / long (1)
to collect water from deep down (1)
ignore large roots
accept to collect more water
- absence of leaves(1)
reduces water loss (1)
- swollen stem (1)
to store water (1)
- roots near surface (1)
to absorb rainwater (1)
- roots widespread (1)
support in sandy soil (1)

2

[4]

Q10.

- (a) points plotted accurately

$$+ \frac{1}{2} \text{ square}$$

deduct 1 mark per error
ignore the line

2

- (b) 30 **or** correct from candidate's graph

accept 30 000 lynx
*do **not** accept 30 000*

1

- (c) (i) fall

mark (i) and (ii) separately

1

- (ii) fewer hares **or** lack of food

*do **not** accept no hares or food*

- 1
- (d) kills / preys / preys on / hunts / catches
and eats / for food (other) animals
*must have the eat **and** kill for the point*

1

[6]

Q11.

The answer to this question requires good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.

maximum of 4 marks if ideas not well expressed

Polar bear has

white fur - camouflage **or** not seen by prey
accept converse points re sun bear

1

thick(er) fur - insulation **or** keeps heat in
number must be comparative
numbers given must be explained
*do **not** accept keeps warm / keeps out the cold*

1

thicker fat - insulation **or** keeps heat in

1

energy reserve **or** can release heat

1

lower S.A - slower / less heat loss
 (re body size)

1

[5]

Q12.

(a) (i) increases

1

(ii) decreases

1

(b) any **two** from:

- competition for water
- competition for ions / minerals / salts / nutrients
accept correct named example
*do **not** accept food*
*do **not** accept all*
- competition for light

2

(c) kills / harms other / named organisms

1

[5]

Q13.

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]

Q14.

(a) (i) 144

1

(ii) 1955 **or** 1979

1

(b) (i) $144 - 12 = 132$

allow 130, 134

allow a transfer error from part (a)

1

(ii) disease **or** predators **or** sterility **or** starvation **or** migration **or** climatic **or** weather change

*award **one** mark for an awareness that any of the following factors could reduce the rabbit population*

accept words to the effect of e.g vegetation decreased = starvation

e.g. humans named as predators

*do **not** accept gender bias of offspring **or** 'too crowded' unless qualified*

1

(c) there's only enough food **or** water **or** space for about 140

do **not** accept statements equating births and deaths or increase or decrease in predators

1

[5]

Q15.

(a) (i) traps air

note 'keeps warm' is stem

1

(increases) insulation effect **or** retains body heat or prevents heat loss

accept air is a poor (thermal) conductor

*do **not** credit acts as a barrier unless qualified by a prevention of heat loss*

1

(ii) **increases** insulation

*do **not** accept keep warm*

1

retains body heat or prevents heat loss

accept:

*stored fat can be broken down **or** respired **or** burned (1 mark)*

credit 'used for energy'

to release (thermal) energy (1 mark)

*do **not** credit create energy*

1

(iii) less **or** smaller surface area (per unit mass or volume)

*accept uses more glucose **or** respire more*

*do **not** credit small surface area*

1

and

less heat loss (for its mass) or explanation of this idea

generates more heat

1

(b) (coloured) to match or blend in with environment

*accept this idea in candidate's own words e.g disguised **or** specific example*

1

any **one** from:
prevents predation
aids hunting

accept this idea in own words

1

(c)

*note: marks are awarded for an indication of enhanced qualities **or** adaptations of xerophytes*
*do **not** credit an unqualified **effect***
*e.g. small surface area **or** they can store water **or** spikes **or** prickly leaves related to protection*

any **two** from:

- widespread roots
- long roots
- spiky leaves or needles
- hidden **or** sunken stomata
- fleshy leaves **or** stems **or** roots for water storage
- leaves arranged to **funnel** dew to roots
- hairy **or** rolled leaves
- light colour

*accept no **or** fewer stomata*

accept no leaves

accept crassulacean acid metabolism

*accept ephemeral (flowering **or** leaf loss **or** production)*

accept reverse diurnal pattern of stomatal opening (stomata open at night)

2

[10]

Q16.

- (a) it has a long/thin beak;
 which enables it to reach down the long flower tube/OWTTE;
(allow qualified answers in terms of wings)
(allow two adaptations)

2

- (b) it has a sharp beak;
 which enables it to peck through the base of the flower tube/OWTTE
(allow qualified answers in terms of feet)
(allow two adaptations)
each for 1 mark

2

[4]

Q17.

- (i) 8
gains 1 mark

1

- (ii) winter
gains 1 mark

1

- (iii) e.g. colder/shorter days
gains 1 mark 1
- (iv) e.g. obtains light needed for food production;
before oak leaves emerge
each for 1 mark 2
- (v) April
gains 1 mark 1
- (vi) e.g. more available food
gains 1 mark 1

[7]

Q18.

- (a) (i) squirrels eat nuts;
each for 1 mark

owls eat squirrels
(2 marks for energy flow) 2
- (ii) hazel tree
gains 1 mark 1
- (iii) 1 squirrel population would decrease;
because fewer nuts available as food
each for 1 mark 2
- 2 owl population would decrease;
because fewer squirrels available as food
each for 1 mark 2
- (b) (i) digested/broken down;
- (ii) by microbes/reference to worm action;
each for 1 mark 2
- (iii) March
warmer/increased activity of worms/microbes;
each for 1 mark 2

[11]

Q19.

- (a) 4 of:
 intensification due to need to improve efficiency of energy transfer;
 has led to developing fast growing crop varieties;
 native plants cannot compete with these;
 for e.g. light/water/minerals;
 effect of herbicides;
 pesticides killing pollinating insects

each for 1 mark

4

- (b) recommend a variety of measures; (can be implied)
 because rotational will allow these species to continue;
 permanent will allow others;
 leading to conservation of a wide range of species

each for 1 mark

4

[8]

Q20.

- (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]

Q21.

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]

Q22.

(a) 2 of e.g.
competition for food competition for space disease

2

(b) e.g.
greys eat greater range of food
greys larger – more effective competitors

2

[4]

Q23.

- (1) A
- (2) C
- (3) B
- (4) D

for 1 mark each

[4]

Q24.

(a) from 20.00 to 4.00
for 1 mark

1

(b) line correct length
for 1 mark

1

(c) e.g. it is dark so fewer predators can see it,
for 1 mark each

2

[4]

Q25.

(a) 1 mark for each correct set of plots
for 1 mark each

2

(b) (i) number of voles/amount of food
for 1 mark

		1	
	(ii) e.g. increased number of owls new disease <i>for 1 mark each</i>	2	
		2	[5]
Q26.			
	(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 <i>for 1 mark each</i>	3	
	(b) they run out of minerals <i>for 1 mark</i>	1	
		1	[4]
Q27.			
	(a) long / pointed horns and for defence long legs and to run away <i>reject strong / powerful legs</i> long legs and to kick predator tall and can see predators a long distance away but accept eyes on side of head and to see predator approaching large ears and to hear predators approaching pattern and for camouflage any <i>two for 1 mark each</i>	2	
	(b) (i) fall in morning / day and rise at night or any reasonable <i>for 1 mark</i> <i>description of whole pattern for one mark</i>	1	
	(ii) loss due to evaporation or transpiration <u>in day</u> / absorbed from air <u>at night / when cool</u> <i>for 1 mark</i>	1	
	(c) (i) 19.30 – 20.30 and 07.30 – 08:30 <i>for 1 mark</i>	1	
	(ii) highest moisture content in grass needs water in desert conditions / response to shortage of drinking water sensible reference to less chance of predation <i>any two for 1 mark each</i>	2	
		2	[7]

Q28.

pros e.g.:

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

cons e.g.:

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]

Q29.

(i) $0.25 \times 100 / 25$

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]

Q30.

camouflage (when hunting)

*accept the idea that the white coat prevents the prey **or**
 predator 'seeing' the Arctic fox*

1

insulation (from cold)

*accept an idea that the thick coat retains body heat **or** traps
 air **or** that air in the fur is a poor conductor **or** keeps it warm*

NEUTRAL RESPONSES –
 protection, waterproof

1

[2]

Q31.

(a) **Quality of Written Communication**

The answer to this question requires ideas in good English, in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.

max 2 if ideas not well expressed

in summer more greenfly

accept increase in population

1

in winter less greenfly

accept decrease in population

1

over the three years greenfly numbers decrease

accept fall or drop for decrease

1

(b) any **one** from

(number of) greenfly

severe **or** cold winters

toxic chemicals

destruction of habitats

disease

predators

weather

temperature

do not accept food

1

[4]

Q32.

any **two** from

swollen stem stores water (for dry periods)

reduced leaves / spines lose less water /less transpiration / less evaporation

idea of long roots absorb water from deeper / more spread out in soil

[2]

Q33.

(a) any **one** from

big, flat feet

long eyelashes

long hair around openings to its ears

1

(b) (the came) does not need insulation
accept can keep warm without the fat 1

(c) any two from:

- (the camel) can drink large amounts of water in one go
- loses little water by urine and/or sweating
- (the camel) can use fat from its hump to produce water
any order for the reasons 2

[4]

Q34.

(a) (long) roots 1

(b) prevents water from evaporating
accept to reduce/stop water loss 1

[2]

Q35.

(a) any **three** from:

space
accept land, room

water
accept rain

nutrients
accept fertilisers, nitrates, minerals
*do **not** accept food*
*do **not** accept just sun*

light

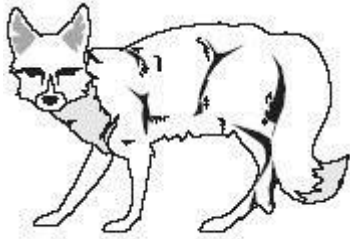
carbon dioxide 3

(b) herbicides 1

[4]

Q1.

The drawings show an arctic fox and a fennec fox.



Arctic fox



Fennec fox

- (a) The arctic fox lives in cold, snowy conditions.

Explain how each of the following helps the arctic fox to survive in these conditions.

- 1 Long, thick fur

- 2 A white coat

(2)

- (b) The fennec fox lives in hot deserts.

Explain how each of the following helps it to survive in hot conditions.

- 1 Very large ear flaps

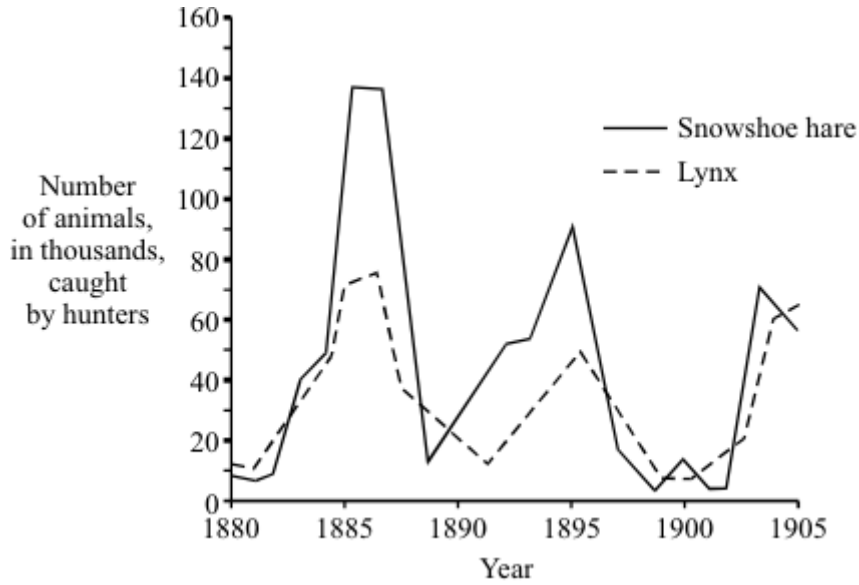
- 2 Hairs on the soles of its feet

(2)

(Total 4 marks)

Q2.

The graphs give information, from a hundred years ago, about the size of the population of snowshoe hares and lynx, which live in northern Canada. Snowshoe hares are herbivores. Lynx are carnivores and prey on snowshoe hares.



(a) Give **three** factors which can affect the size of the snowshoe hare population.

1. _____
2. _____
3. _____

(3)

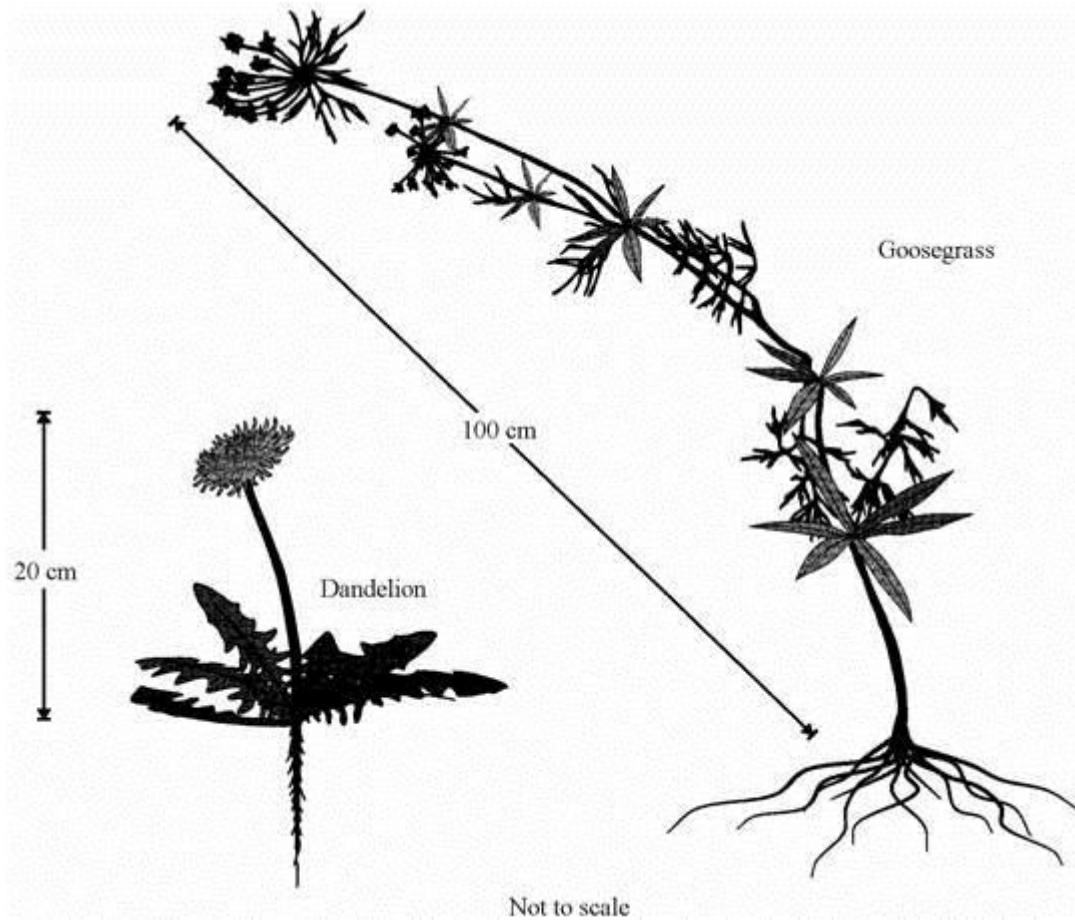
(b) The graph for numbers of lynx shows a similar cycle to that of the snowshoe hares. The peaks for lynx usually occur about a year later than the peaks for the snowshoe hares. Suggest why.

(2)

(Total 5 marks)

Q3.

Dandelions have become adapted to live in lawns and grass areas where animals graze. Goosegrass, however, has become adapted to live alongside hedgerows and cannot survive being mown.



(a) Use the information in the drawings to suggest **one** advantage of each of the following adaptations.

(i) Dandelion leaves lie flat on the ground.

(1)

(ii) A dandelion has a thick tapered root.

(1)

(iii) Goosegrass stems are long.

(1)

(iv) Goosegrass roots are thin and very long.

_____ (1)

(b) Dandelions and goosegrass are different species of plants.

(i) What name is given to the unit of inheritance which controls one particular characteristic of a plant or animal?

_____ (1)

(ii) Why would you be unlikely to succeed if you tried to breed a new species of plant by crossing a dandelion with goosegrass?

_____ (1)

(c) Animals as well as plants have become adapted to live in different environments.

State **one** way a polar bear has become adapted to living in the Arctic, and the reason for the adaptation.

_____ (2)
(Total 8 marks)

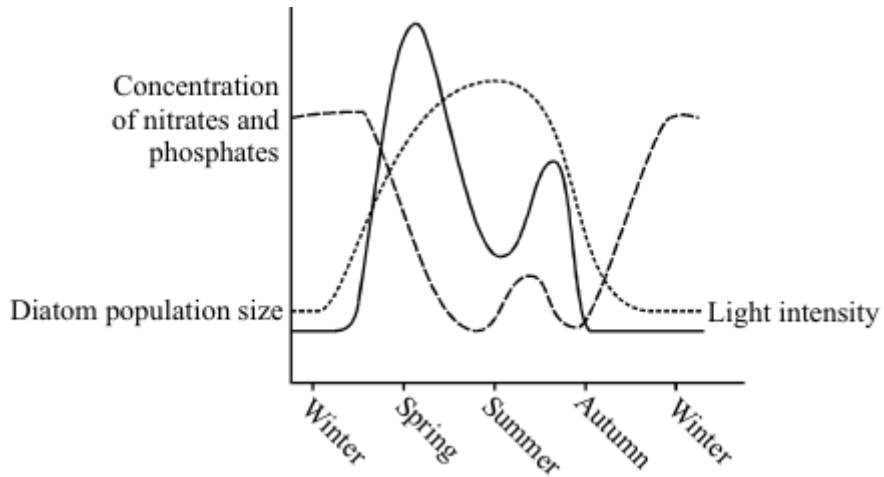
Q4.

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.



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

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

(a) (i) Was he correct? _____

Give reasons for your answer.

(2)

(ii) Explain how you could test to see if his answer was correct.

(2)

(b) The hedge was cut down and removed.

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

Explain your answer. _____

(2)

(Total 6 marks)

Q7.



Tree on its own



Trees inside a wood

The drawing above shows the shapes of trees grown on their own and inside a wood.

- (a) Write down **two** differences you can see between the tree grown on its own and those growing inside a wood

1. _____

2. _____

(2)

- (b) Trees inside the wood have to compete with each other for the things which they need to grow.

List **three** things for which the trees compete.

1. _____

2. _____

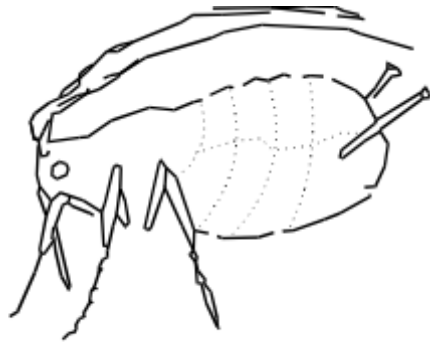
3. _____

(3)

(Total 5 marks)

Q8.

The greenfly is an insect which is eaten by ladybirds.



Greenfly

- (a) (i) What do we call animals, like the ladybird, which hunt and kill other animals for food?

_____ (1)

- (ii) What do we call animals, like the greenfly, which are eaten by other animals?

_____ (1)

- (b) What would happen to the number of ladybirds if the numbers of greenfly suddenly dropped?

_____ (1)

Give a reason for your answer.

_____ (1)

- (c) Suggest **two** factors, other than the number of ladybirds, which could affect the number of greenfly.

1. _____

2. _____

(2)

(Total 6 marks)

Q9.

A particular species of snail has a shell which may be pink, yellow or brown. It may also be plain or have bands running round it.

The snails are eaten by song thrushes.

Explain why snails with plain brown shells are the most common in hedgerows.

(Total 4 marks)

Q10.

The diagrams show maize plants grown from seeds sown at different distances from each other.



(a) Write down **two** differences you can see between plants A and B.

1. _____

2. _____

(2)

(b) The differences are caused by competition between the maize plants.

The maize plants are competing for **light**. The maize plants are also competing for _____
and _____

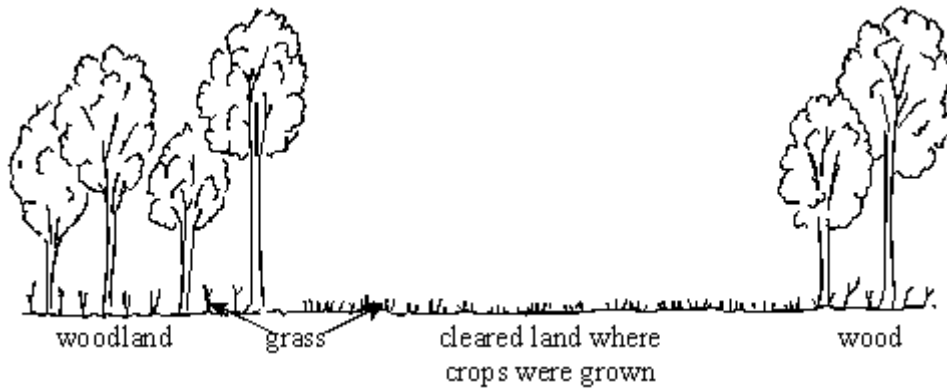
(2)

(Total 4 marks)

Q11.

In some developing countries woodland is cut down and burned. The ash acts as fertiliser. Crops are grown for three years. The land is then left as it is too poor to grow any more

crops.



- (a) In the original woodland trees and plants died and grew for hundreds of years. When cleared the land grew crops for only three years. Explain this difference in as much detail as you can.

(3)

- (b) What could farmers do to make crops grow on the cleared land for more than three years?

(2)

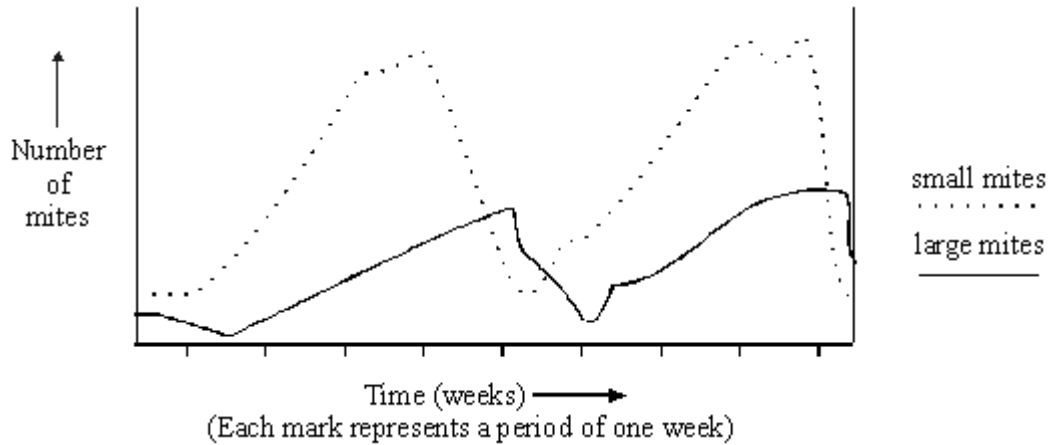
(Total 5 marks)

Q12.

Some small mites feed on the leaves of orange plants. Larger mites feed on the smaller mites.

- (a) What do we call animals, like the large mite, which eat other animals, like the small mite?

(1)



The graph shows how the number of these mites changes over a period of time.

- (b) (i) What happens to the number of large mites one week after the number of small mites decreases?

Suggest a reason for this.

(3)

- (ii) What happens to the number of small mites as the number of large mites increases?

Suggest a reason for this.

(2)

(Total 6 marks)

Q13.

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.



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)

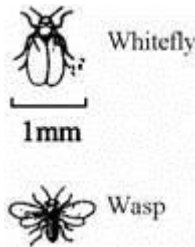
- (b) Suggest **one** possible way, giving **one** advantage and **one** disadvantage, that this New Zealand flatworm could be controlled.

(3)

(Total 7 marks)

Q16.

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



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

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

decomposer predator prey producer

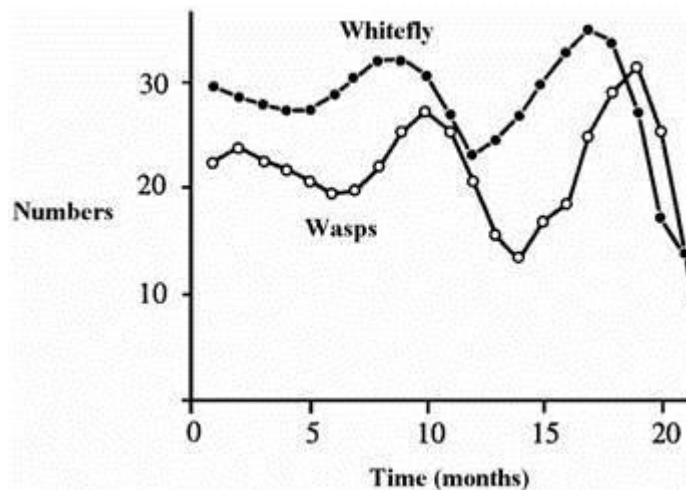
The wasp larva feeds on the whitefly larva.

The wasp is a _____

The whitefly is known as the wasp's _____

(2)

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



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

Why do you think this happens? _____

(4)

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

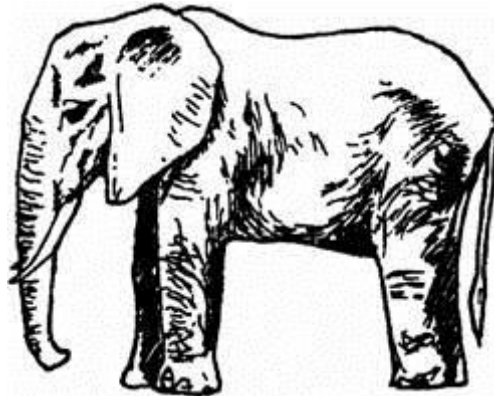
(1)

(Total 7 marks)

Q17.

The elephant is likely to become extinct in parts of Africa.

Use the information below to explain **three** reasons why.



- * The African elephant eats lots of trees and other plants for food.
- * In Africa the human population is increasing and more food is needed to feed the extra people.
- * More trees are cut down for fuel and to clear land for growing crops.
- * Elephants are killed by poachers who want the ivory from their tusks.
- * A herd of elephants needs a large area in which to live and feed.

1. _____

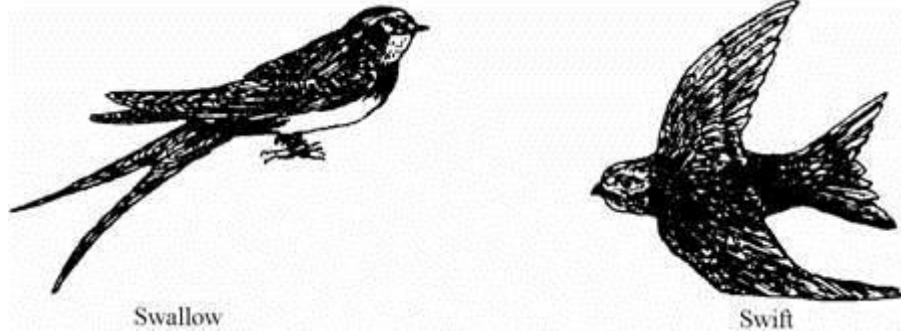
2. _____

3. _____

(Total 3 marks)

Q18.

Study the following information, then answer the questions.



- Swallows and swifts spend the summer in Britain and the winter in Africa.
- Swallows feed on insects near the ground.
- Swifts feed on insects high in the air.
- Swallows come back to Britain in spring before swifts.
- In spring the ground starts to warm up. When it is warm it makes the air rise. Insects are carried up in this air.

(a) Suggest two reasons why swifts and swallows fly to Africa for the winter.

1. _____
2. _____

(2)

(b) How do swifts and swallows avoid competing for food?

(1)

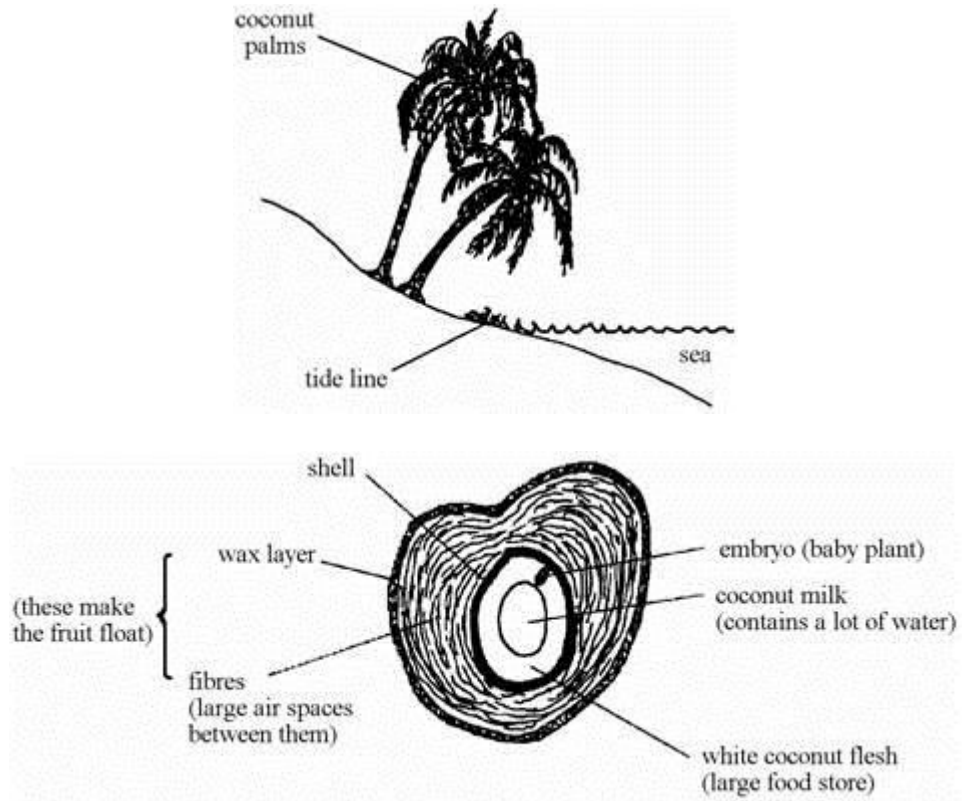
(c) Suggest why swifts come back to Britain later than swallows.

(2)

(Total 5 marks)

Q19.

Coconut palms grow just above the tide line on beaches of tropical islands.



Section through a coconut fruit

The sea carries the fruit to new parts of the beach.
The embryo then puts out its first root.
Fresh water and nutrients are very deep down under the sandy beach.

Explain **three** ways in which the coconut palm is adapted so that its embryo plants can spread and survive.

1. _____

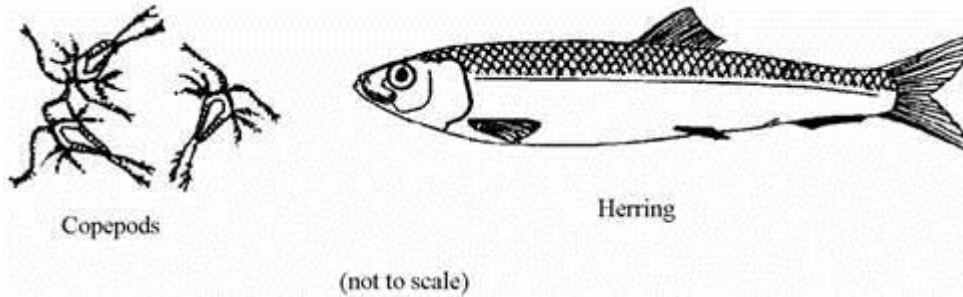
2. _____

3. _____

(Total 3 marks)

Q20.

Copepods are tiny animals which live in the sea.



During the day they live deep down near the sea bed.
At night they move up to the surface where they feed on tiny plants.
When the sun rises they move down to the bottom again.

- (a) Suggest why the tiny **plants** live near the surface of the sea.

(2)

- (b) Herring feed on copepods.

Where will herring be found during the day? Give a reason for your answer.

(2)

(Total 4 marks)

Q21.

Kangaroo rats live in the hot, dry deserts of North America.
Their only water comes from the food they eat.
In these regions daytime temperatures are around 45°C.
At night temperatures can fall to below 30°C.



Explain how each of the following features makes these animals well adapted to survive in deserts.

- (a) They are a sandy colour.

- (b) They are active at night and stay in burrows underground by day.

(c) They produce dry droppings and very little urine. They do not sweat.

(d) Their large ears, feet and tail give their bodies a large surface area.

(4)
(Total 4 marks)

Q22.

Brown trout are fish that kill and eat other animals.

(a) Choose a word from this list to complete the sentence below.

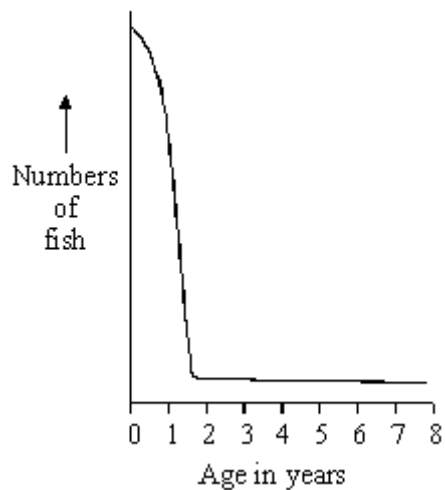
competitors consumers prey producers

Trout are predators, the animals they eat are their _____ .

(1)

(b) The graph shows the ages of the brown trout found in the river Tees.

There was no serious pollution in the river during this time.



Suggest **three** reasons why few brown trout live to be over two years old.

1. _____
2. _____
3. _____

(3)
(Total 4 marks)

Mark schemes

Q1.

- (a) 1 for insulation / prevents heat loss
keeps cold out neutral keeps it warm neutral 1
- 2 camouflage / other animals cannot see it 1
- (b) 1 heat loss
reject shade 1
- 2 insulation from hot sand / prevents heat passing from sand / prevents burning 1

[4]

Q2.

- (a) any **three** from
different factors are required for each mark
- hares breeding
 (amount) of food **or** plants available
 eaten by lynx **or** predators **or** reference to size of lynx / predator population
 hares dying **or** reference to being killed by humans
 disease (spreads through the population)
 (competition) for space **or** (lack of) space
*alternative to either of these points but not both change in environment **or** habitat*
- temperature **or** weather **or** climate 3
- (b) any **two** from
- more food **or** hares for lynx encourages more breeding (in lynx)
accept less food, less breeding
- more food **or** hares allows greater survival rate of cubs **or** adult lynx
accept less food, less survival
- idea of time lag for breeding **or** time lag for dying 2

[5]

Q3.

- (a) (i) to go under teeth **or** mower
accept not damaged by grazing animals
accept do not get cut or bitten
accept reduces competition by other plants
do not credit maximum surface of leaves facing Sun 1
- (ii) any **one** from
 it can force its way through grass roots
accept in competition with grass roots
 it is a store of food (to help the plant recover)
do not credit a good store of water
 to reach down to water
 to give good anchorage
accept it is hard to pull up 1
- (iii) any **one** from
 to reach more light
*accept to get out of the shadow of the hedge **or** tall grass*
 to let seeds be caught on animals' coats (more easily)
*accept improves access **or** visibility **or** ease for pollination*
do not credit to help it grow up the hedge 1
- (iv) any one from
 (they reach out from hedge) to find water
accept increase surface area
*accept to find nutrients **or** minerals*
do not award mark if food mentioned
 to give good anchorage 1
- (b) (i) gene **or** allele
do not credit chromosome 1
- (ii) any **one** from
 they do not crossbreed **or** interbreed

*accept different species do not breed together **or** do not fertilise each other*

do not produce fertile offspring

have different numbers or types of chromosomes

accept genes are incompatible

*do not credit have different genes **or** are genetically different*

do not credit do not pollinate each other

1

- (c) one mark is for the adaptation and one is for an appropriate reason

have white fur

for camouflage

are huge

for large volume to surface area

thick layer of fat

*for insulation or to reduce heat loss **or** retain heat*

*do not credit to stop it losing heat **or** withstand the cold **or***

keep it warm

have thick fur

*for insulation **or** to reduce heat loss **or** retain heat*

hibernate

to avoid the coldest part of year

is a carnivore

because animals provide high energy food

has big paws **or** claws

to be able to walk on snow

have small ears

to reduce heat loss

have furry feet

for insulation from the snow

2

[8]

Q4.

- (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*

- 1
- do not accept they need light*
- (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]

Q5.

- (food chain) A gives 7200kJ
(of useful energy)
- or** 7.2MJ
or 7200000J
unit essential in each case
- 1
- (food chain) B gives 960kJ (of useful energy)
- or** 0.96MJ
or 960000J
*unit essential in each case
credit 1 mark if **both** are numerically
correct but unit omitted*
- 1

same comparison made in **each** case
e.g. for each kilogram of grain

*or refers to more stages in food chain
results in less efficiency*

1

(so) (food chain) A is 7.5 times more efficient than (food chain) B

*or for every unit of useful energy given
to a person by B, A gives $7\frac{1}{2}$ units
or food chain B is only 13(.3)% as
efficient as food chain A
or makes a correct comparison
in percentage terms*

1

[4]

Q6.

- (a) (i) correct reasons - different
light protection
moisture pH/acidity/alkalinity
temperature soil
nutrients air
genetic differences

any 2 for 1 mark each

[mark solely on different environmental condition]

2

- (ii) grow different dandelions in the same conditions
for 1 mark each

or

grow the same type of dandelions in different conditions
for 1 mark each

2

- (b) dandelions shorter/smaller/same height
for 1 mark

because (named) condition changes
for 1 mark

[may refer to answer in a(i)]

2

[6]

Q7.

- (a) trees in wood (allow converse)

taller
fewer leaves
thinner trunks
fewer branches
branches/leaves at top only

*any 2 for 1
mark each*

2

- (b) light
water
space
nutrients
(allow up to 2 named substances e.g. CO₂/O₂/NO₃)

any 3 for 1 mark each

3

[5]

Q8.

- (a) (i) predator (allow carnivore)

- (ii) prey

each for 1 mark

2

- (b) fewer ladybirds; because less food/ladybirds starve
or
no change; because alternative food supply

each for 1 mark

2

- (c) any two suitable environmental effects e.g.
food;
diseases;
other predators;
space;
insecticides

any two for 1 mark each

2

[6]

Q9.

idea brown colour/plain shell inconspicuous
for 1 mark

less likely to be eaten

gains 1 mark

but

less likely to be eaten before breeding

gains 2 marks

so alleles (genes) passed on

for 1 mark

(N.B accept inverse of any of the above)

[4]

Q10.

- (a) B plants are:
taller
smaller/thinner leaves
thinner stem or vice versa in referring to A plants

any two for 1 mark each

2

- (b) water/rain/moisture
nutrients/any specific mineral (N/P/K)

each for 1 mark

2

[4]

Q11.

- (a) *idea:*
wood goodness recycled/crops goodness removed

gains 1 mark

1

but

wood minerals/nutrients recycled/crops remove nutrients/minerals

gains 2 marks

wood and crops compared

for 1 mark

2

- (b) (add) fertiliser/nutrients/minerals
(add) manure/animal waste/compost

any two for 1 mark each

(accept move to new area for 1 mark)

rotation

max marks 2

2

[5]

Q12.

- (a) predator/carnivore
(not consumer/hunter)

for 1 mark

1

- (b) (i) number decrease
 not 'no' less food (for large mites)/less prey/fewer small mites to eat
 (not 'fewer small mites' etc)
 starve/cannot grow/cannot breed/die/die out
each for 1 mark 3
- (ii) increase small mites breeding faster (than they are eaten)
each for 1 mark
- (accept different food found)
 decrease = 0 maths but 1 mark for possible reason can be awarded -
 more (small mites) eaten
each for 1 mark 2

[6]

Q13.

- (a) idea
- unbanded dominant/plain **or** banded recessive
 - because banded appears in young/
 - parents heterozygous/Bb
 - offspring

BB	}
Bb	}
Bb	}
bb	}

 credit response consistent with parents
 even if not both heterozygous
- 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]

Q14.

idea

- banded snails camouflaged/less easily seen
- fewer banded eaten [by birds]
- more banded survive to breed
- 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]

Q15.

(a) *idea:*

soil wetter
soil less aerated
less food for moles/voles/foxes/badgers/birds
soil less fertile (less leaves in soil not enough on its own)
less food grown
earthworms die out/fewer earthworms
(not 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 control/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]

Q16.

- (a) predator
prey

*no alternatives
for 1 mark each*

2

- (b) *idea that*
(wasps) increase OR decrease
gains 1 mark

but
(wasps) increase then decrease/peaks at
*gains 2 marks
answers must match*

idea of change in food supply/whiteflies
more food/whiteflies OR less food/ whiteflies
gains 1 mark

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

or
wasps follow trend in whiteflies
for 2 marks

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

4

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

1

[7]

Q17.

Factor and effect needed.

idea

- killed by poachers (for tusks/ivory)
- not enough food for elephants because humans cut down trees
- not enough space because more used by people/agriculture
- food/space destroyed by humans
- killed for food

any three for 1 mark each

[3]

Q18.

(a) too cold in Britain / warmer in Africa

- no insects / food in Britain / insects / food in Africa / insects are hibernating in Britain

each for 1 mark

[Take answers to refer to Africa unless otherwise stated]

[Do not allow 'because of climate']

2

(b) feed at different heights

for 1 mark

[Comparison is required if answer is quoted from information given]

1

(c) insects they eat are carried up on air currents
this doesn't happen until ground / air has warmed

for 1 mark each

2

[5]

Q19.

ideas that

- trees hang over the sea / grow close to the sea / on the shore – coconuts drop into the sea. or similar (*not just simply 'spread'*)
- wax / fibres (trapped air) – stop the fruit sinking / provide water resistance
- water store – supply water until root reaches a supply
- nutrient store – supply nutrients/salts until root reaches supply
- hard shell – to protect from breakage on landing / to protect the embryo from feeding animals.

*[Award maximum of 1 mark for 2 survival / spread features
or 1 survival + 1 spread feature]*

for 'Fibres stop the fruit sinking'

'Wax provides water resistance'

Award 2 marks

any three for 1 mark each

[3]

Q20.

(a) idea that

- light doesn't reach deeper parts
- plants need / absorb light
- to make food

gain 1 mark each to maximum of 2

but

so they can photosynthesise

gains 2 marks

2

(b) herring will be on the bottom
herring follow / will be feeding
on the copepods

independent marking points

for 1 mark each

2

[4]

Q21.

(a) idea of camouflage / blend in with / protection against predators

for 1 mark

1

(b) only active when it is cool / stay out of the heat by day / avoid
predators / it is cooler

for 1 mark

1

(c) conserve / do not waste water / do not lose water / avoid dehydration /
can't obtain water easily / only get water from food

for 1 mark

1

(d) release body heat / keep cool

(allow feet / tail stop rat sinking into sand / keep balance / for stability
/ easier movement in sand / run faster)

for 1 mark

1

[4]

Q22.

(a) prey

for 1 mark

1

- (b)
- disease
 - eaten (by predators) / predators
 - (over)fished / caught by fishermen
 - competition for food / not enough food (for all the baby fish) / no food

(do not allow they migrate or move elsewhere)
any three for 1 mark each

3

[4]