

Q1.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

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

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Adaptation 2

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

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(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

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

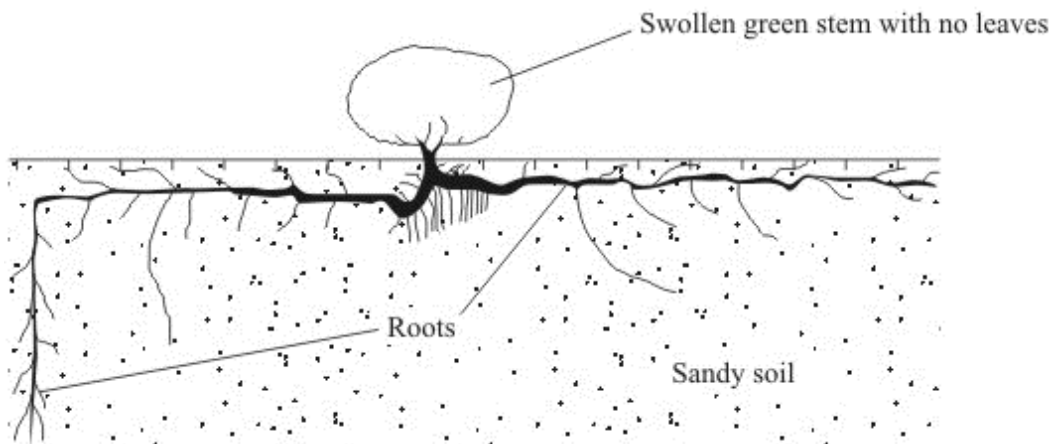
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(2)
(Total 6 marks)

Q2. 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

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How this adaptation helps the bean caper to survive

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Adaptation 2

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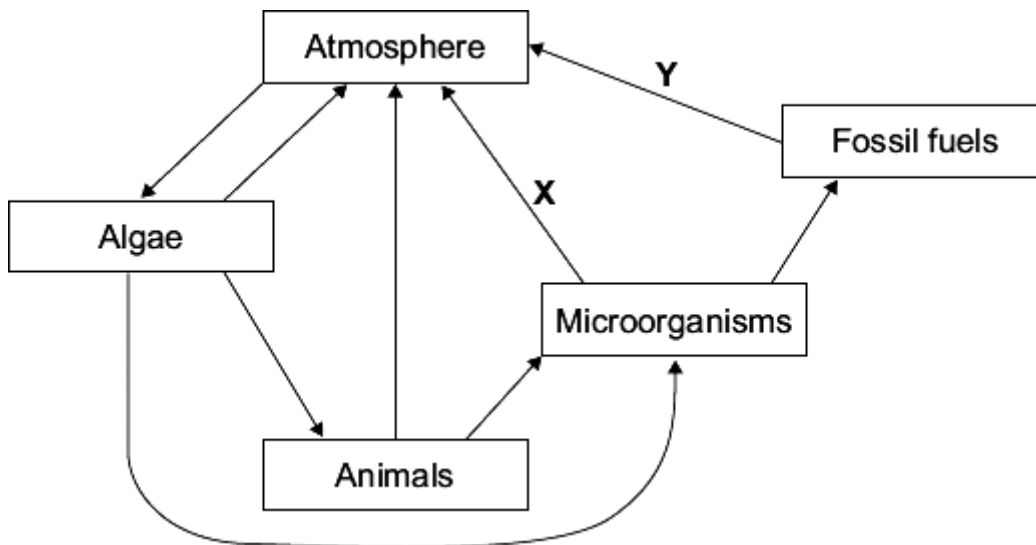
How this adaptation helps the bean caper to survive

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(Total 4 marks)

Q3. The diagram shows part of a carbon cycle in a habitat.



(a) Name the processes shown by arrows X and Y.

X

Y

(b) Describe the part played by algae in this carbon cycle.

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(3)

(c) In tropical rainforests process X is much faster than in most other habitats.
Suggest why.

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(2)

(Total 7 marks)

Q4. Each autumn, many trees lose their leaves.

(a) Describe how carbon compounds in the leaves can be recycled so that they can be used again by the trees.

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.

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(4)

(b) Give **two** environmental conditions which speed up the processes that you have described in part (a).

1

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(2)

(Total 6 marks)

Q5.A group of students investigated populations in a food chain in a garden.

The table shows the estimates of the number and biomass of some of the organisms the students found.

Organism	Number in the garden	Mean mass of each one in grams	Biomass of population in grams
Hedgehog	1	200	200
Slug	600	2	1200
Lettuce	60	100	

(a) (i) Calculate the biomass of the lettuce population.

Show clearly how you work out your answer.

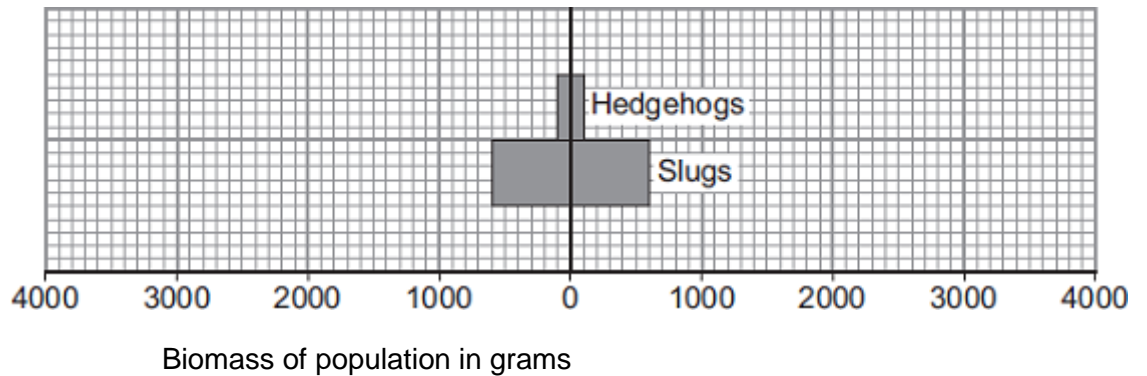
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Biomass = grams

(2)

- (ii) Use your answer to part (a)(i) to complete the pyramid of biomass.
 Show the biomass of the lettuce population in the garden.



(2)

- (b) The energy in the hedgehog population is much less than the energy in the slug population.

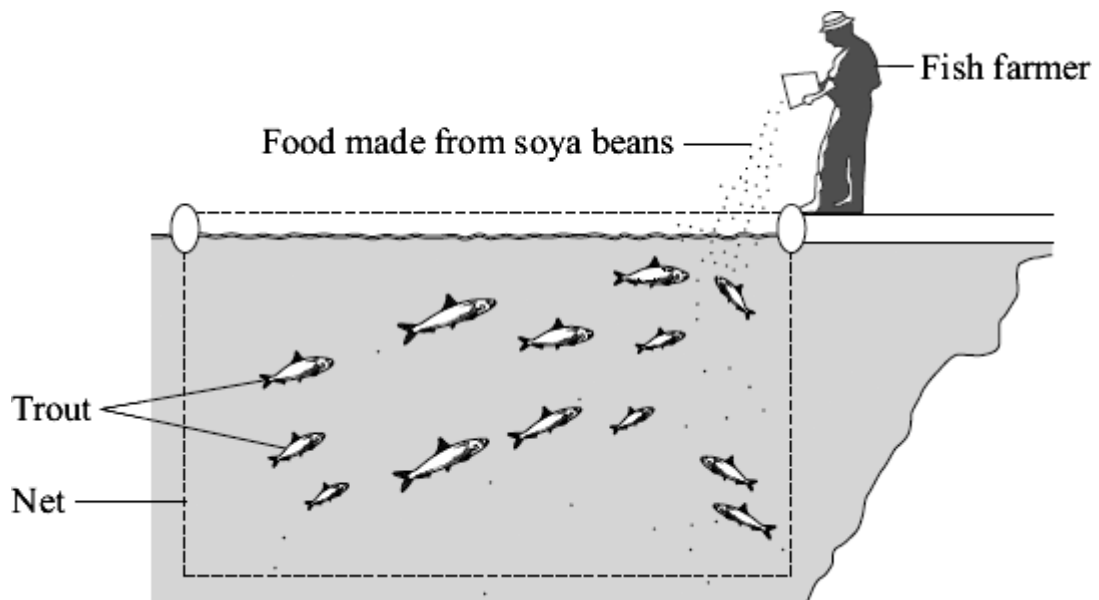
Explain why as fully as you can.

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(3)

(Total 7 marks)

Q6. A fish farmer keeps trout in a large net in a lake.



The fish farmer feeds the trout on food made from soya beans.

When the trout are large enough the farmer sells them for food for people.

(a) Draw a pyramid of biomass for the three organisms in this food chain.

Label the pyramid.

(2)

(b) It would be more energy efficient if people ate the soya beans rather than eating the trout.

Which **two** of the following are reasons for this?

Tick (✓) **two** boxes.

Some people do not like eating animals such as trout.

The trout release energy when they respire.

Soya bean plants release energy when they respire.

Some energy will be lost in waste from the trout.

Soya bean plants absorb energy during photosynthesis.

(2)

(c) Suggest **one** advantage to the fish farmer of keeping the trout in a large net instead of letting them swim freely in the lake.

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(1)

(d) Some trout die before they are large enough to be sold.
The dead trout contain carbon.

Use your knowledge of the carbon cycle to describe how this carbon is returned to the atmosphere after the trout die.

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(2)

(Total 7 marks)

Q7. 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.

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(2)

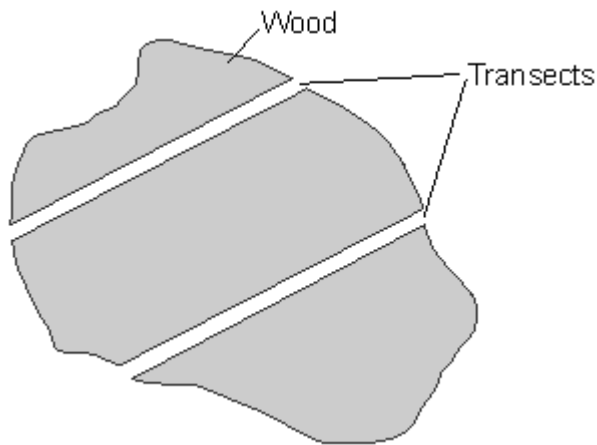
(Total 6 marks)

Q8. Red squirrels live in trees. They eat seeds from the cones of conifer trees. Squirrels store cones in 'larders' on the ground. These larders provide food through the winter. Each red squirrel makes and defends one larder.

Scientists monitor squirrel numbers to find the best habitats for the squirrel's survival. In one investigation, scientists estimated the numbers of squirrels in different types of woodland. Each woodland contains a different species of conifer tree.

Here is their method.

- Ten woods of each type of woodland were surveyed.
- In each wood scientists measured out two transects (strips), each 600 m long and 10 m wide.
- A scientist walked slowly down the centre of each transect, recording the number of squirrel larders he could see.



(a) Name **one** variable that was controlled in this investigation.

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(1)

(b) (i) The scientists recorded the number of larders instead of the number of squirrels they saw.

How could this have increased the accuracy of the investigation?

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(1)

(ii) This method of counting the number of larders could have led to an inaccurate estimate of the number of squirrels.

Explain how.

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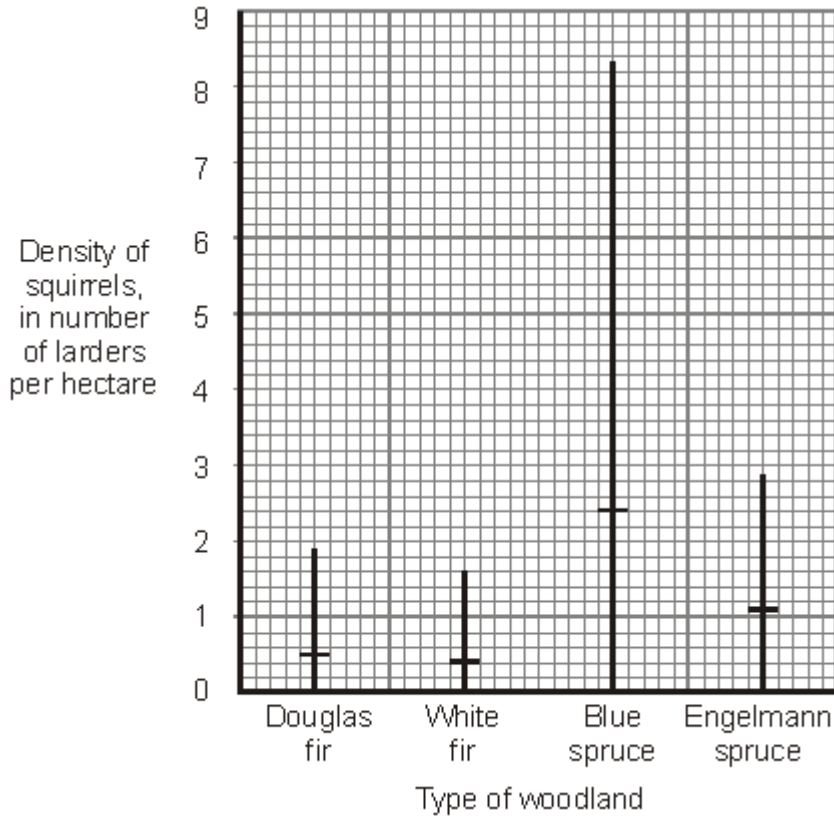
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(2)

(c) The results of the investigation are shown on the graph.



Each bar represents the range of the number of larders in each type of woodland.

The horizontal mark on each bar represents the mean number of larders per hectare of woodland.

(c) A student concluded 'You will always find more squirrels in spruce woodland than in fir woodland.'

Is the student's conclusion justified by the data in the graph?

Explain the reasons for your answer.

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(2)
(Total 6 marks)

Q9. *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.

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(6)
(Total 6 marks)

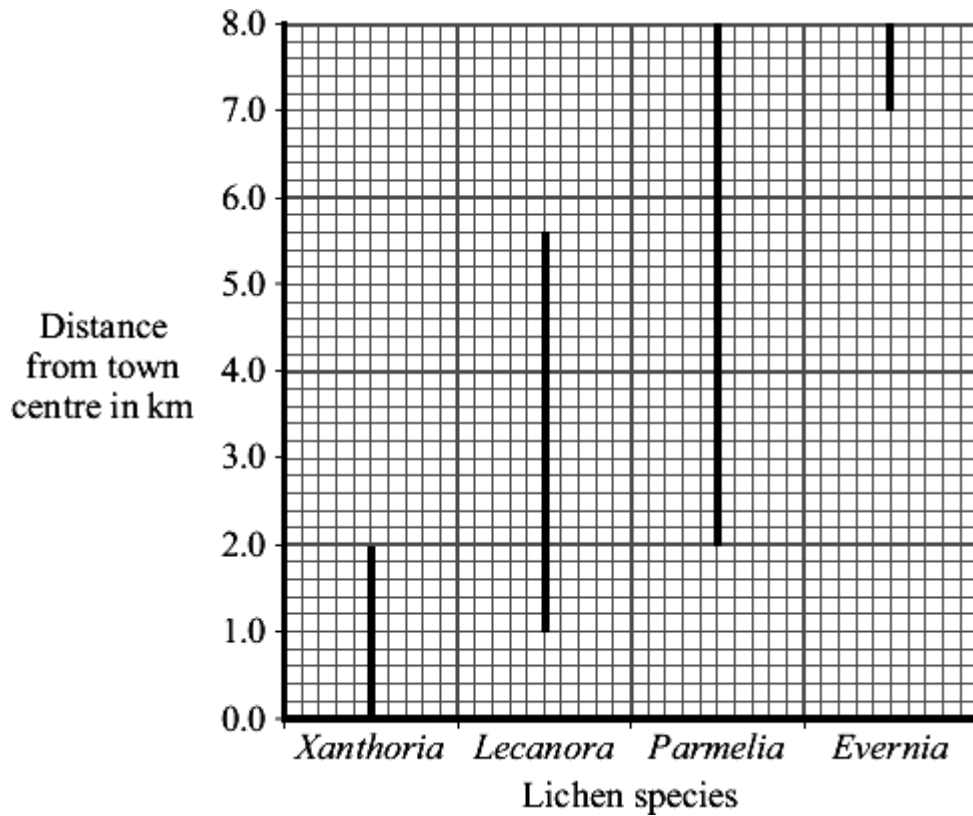
Q10. Lichens are sensitive to the amount of sulfur dioxide in the atmosphere. They are used as indicator species for the amount of air pollution. Air pollution is generally higher in town centres than in the countryside.

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

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

The graph shows their results.

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



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

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(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

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2

.....

(2)
(Total 5 marks)

M1.(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]

M2. 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]

M3. (a) **X** respiration

correct order only

allow decay / decomposition / rotting

ignore breakdown / disintegrate

1

Y combustion / burning

1

(b) any **three** from:

- photosynthesise / absorb carbon dioxide
accept are producers or produce / make biomass / glucose / other named
do not accept photosynthesis releases CO₂
- release carbon dioxide / respire
- eaten by animals
- fed on / decayed by microorganisms

ignore eaten by microorganisms

3

(c) any **two** from:

(in tropical rainforest conditions are)

- warm(er) / hot
- damp / moist / wet / humid
ignore rain
- a lot of microorganisms
- a lot of material to decay
allow warm(er) so enzymes work faster for 2 marks

2

[7]

M4. (a) **Quality of written communication:**

ideas given in a sensible order

broken down

giving products (could be CO₂, minerals or gas)

(used by trees)

Q ✓ or Q ✗

1

any **three** from:

- microorganisms / bacteria / fungi / saprotrophs
- accept saprophytes / saprobionts / detritivores (named)
- digest / break down organic matter / leaves / decompose / reference decomposers / decay / rot
- use of enzymes / correct named example
- absorption by diffusion / active transport
- must be of breakdown products
- respiration / combustion

- release of carbon dioxide

CO₂ can be used (by trees) in photosynthesis
do **not** accept CO₂ taken in by roots

3

(b) any **two** from:

- warmth / suitable temperature
do **not** accept heat / hot weather
- damp / water / rain / humid / moisture
- oxygen
- suitable pH

2

[6]

M5.(a) (i) 6000

*award 2 marks for correct answer irrespective of working
allow 1 mark for 60 × 100 with incorrect or no answer
allow answer in table if answer line blank*

2

(ii) bar width 6000 **or** to match answer to (a)(i)
anywhere on scale ignore depth / height of bar

1

drawn below slugs
label not required

1

(b) any **three** from:

*ignore references to number / size / mass of organisms
assume reference is to / of hedgehog unless stated
otherwise*

- respiration (by hedgehog)
*do **not** accept idea that respiration uses / produces energy*
- faeces (of hedgehog) **or** (slug) not absorbed (by hedgehog) **or** (slug) not digested (by hedgehog)
- excreted / urine / urea (by hedgehog)



accept waste for 1 mark if neither faeces nor excretion point made

- not all slug (s) eaten (by hedgehogs) **or** some slugs eaten by other things **or** not all parts (of slug) eaten
ignore (some) slugs die
- movement (by hedgehog)
- heat (from hedgehog)
allow appropriate references to biomass lost by these methods, rather than energy losses

3

[7]

M6. (a) three layer triangular pyramid
either way up (as blocks or triangle)

1

(soya / beans / food – trout / fish – people / human (in sequence)
ignore reference to producers / herbivores / consumers
award 1 mark only for a correct food chain with 2 correct arrows showing energy flow

1

(b) the trout release energy when they respire

1

some energy will be lost in waste from the trout

1

(c) any **one** from eg

- easy / easier to catch / more caught
allow easy / easier to monitor
- easy / easier to feed
allow control food
- no / less predation
allow less fishing / poaching
- less energy loss
allow grow faster
- less movement
ignore less space to move
*do **not** allow easier to farm*

1

(d) any **two** from:

- *microorganisms / bacteria / decomposers / microbes / fungi / detritus feeders*
- *decay / rot / decompose / digest / break down*
ignore biodegrade
- *(microorganisms) respire*
*do **not** award this mark if response implies the trout respire*
- *turned into fossil fuels / named fossil fuels*
- *carbon dioxide / CO₂ released*

2

[7]

M7. (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]

- M8.** (a) *area of strips / length of transects / number of transects* 1
- (b) (i) *since squirrels are mobile and could be missed / counted twice* 1
- (ii) *numbers of larders observed likely to be lower than actual*
*do **not** accept squirrels share larders or squirrels have*
more than one larder 1
- since unlikely that all could be spotted if 5 m away **or***
*old larders **or***
squirrels moved on / died 1
- (c) (no)
- the bars show the range of the number of squirrel larders in*
the different types of woodland 1
- although spruce woodlands have the larger ranges, some*
spruce woodlands will have very low numbers of larders 1

[6]

M9. 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]

M10. (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]**