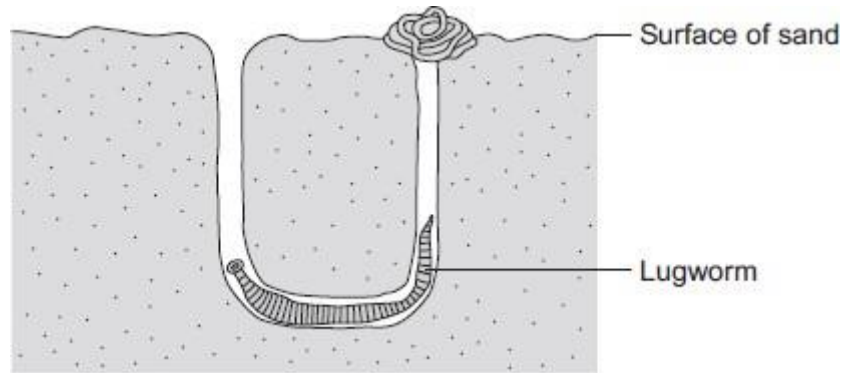


1 The lugworm lives in a U-shaped burrow in the sand on the seashore.

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)

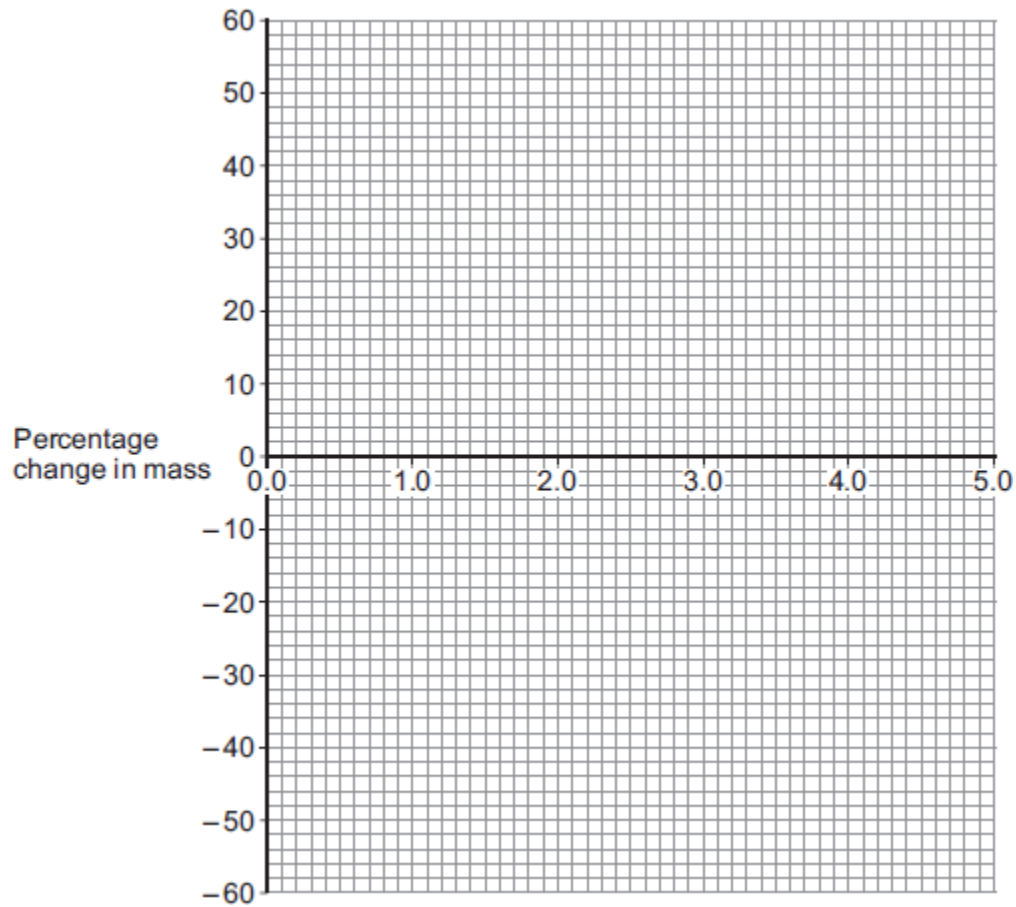
- (ii) Calculate the percentage change in mass for the 10 lugworms in the salt solution with a concentration of 2.0 arbitrary units.

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)

2

Deforestation affects the environment in many ways.

(a) Deforestation increases the amount of carbon dioxide in the atmosphere.

Give **two** reasons why.

1. _____

2. _____

(2)

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

(i) What is meant by *biodiversity*?

(1)

(ii) Give **two** reasons why it is important to prevent organisms becoming extinct.

1. _____

2. _____

(2)

(Total 5 marks)

3

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 _____

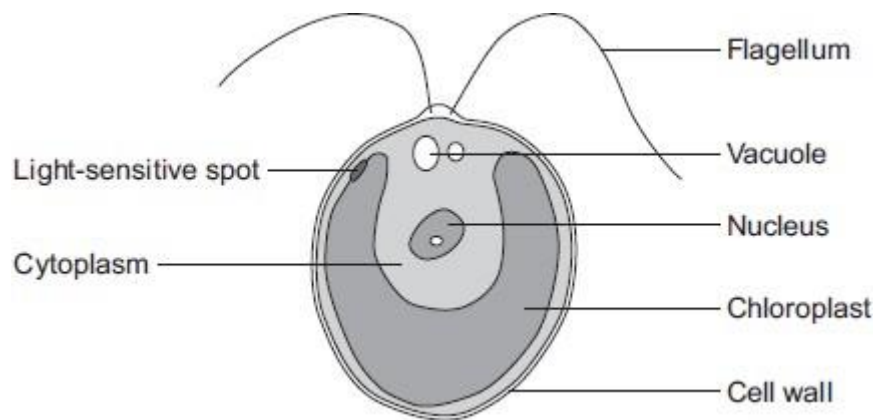
How this adaptation helps the antelope avoid being killed by predators.

(2)

(Total 6 marks)

4

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?

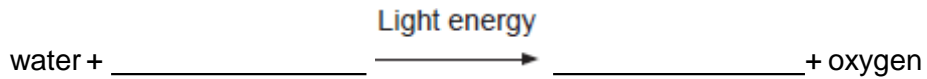
(1)

(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)

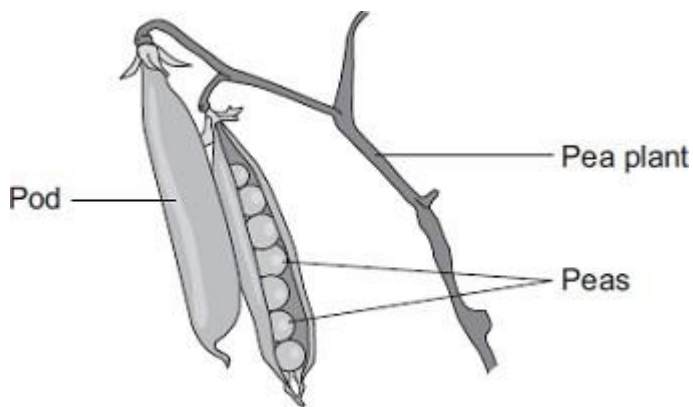
(d) Multicellular organisms often have complex structures, such as lungs, for gas exchange.

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

(3)

(Total 11 marks)

5 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)

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

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

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

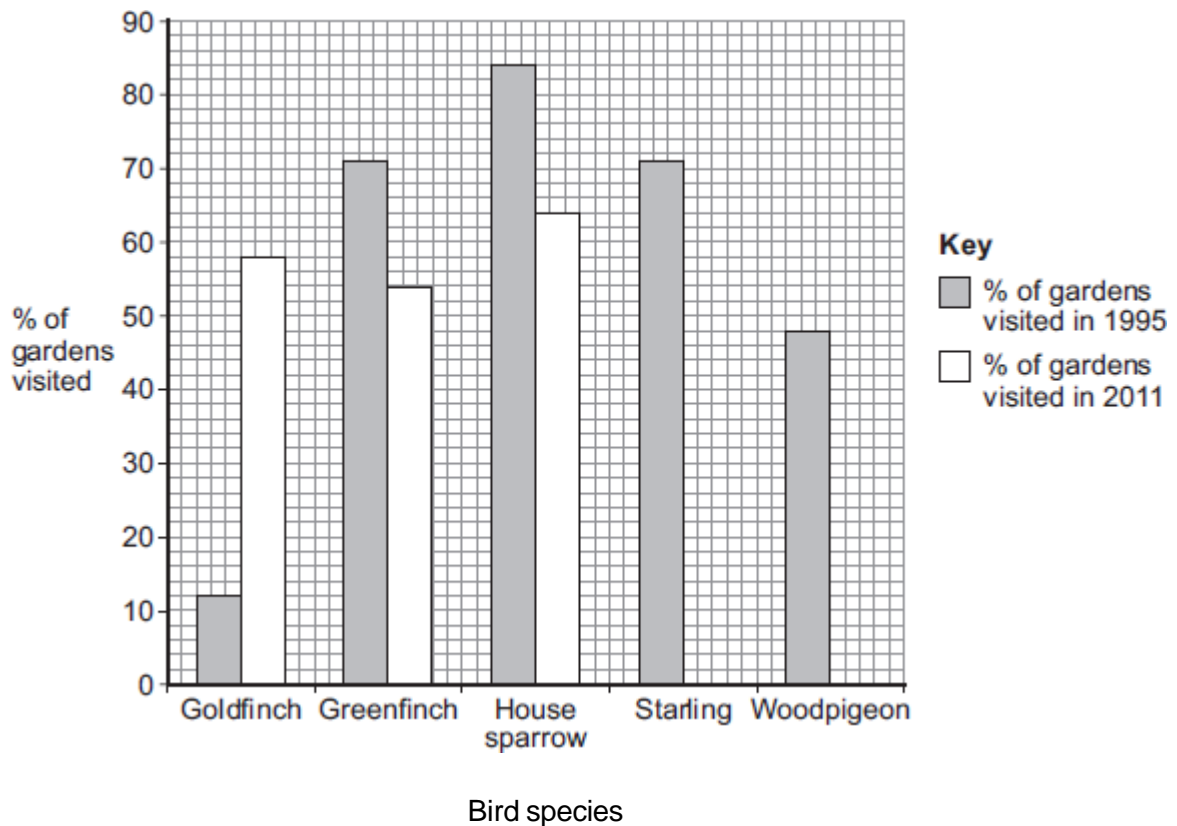
The table below shows the percentage (%) of gardens visited by different bird species in 1995 and in 2011.

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

(1)

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

Some have been done for you.



(2)

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

How many gardens were visited by woodpigeons in 2011?

(2)

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

(1)

(c) The change in the number of woodpigeons may be partly because they have spread to towns and cities.

Suggest why this increase in woodpigeons in towns and cities might have occurred.

(1)

(Total 7 marks)

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

Deforestation affects the environment.

Deforestation is causing a change in the amounts of different gases in the atmosphere. This change causes global warming and climate change.

The image below shows an area of deforestation.



© Nivellen77/iStock/Thinkstock

Give the reasons why deforestation is taking place.

Describe how deforestation is causing the change in the amounts of different gases in the atmosphere.

Extra space _____

(Total 6 marks)

Mark schemes

- 1** (a) (i) variation in masses / more representative / more typical / more reliable / average / mean / reference to anomalies
- or**
- one worm to light to measure change
do not allow more accurate / more precise
ignore fair test / valid / repeatable / reproducible
- 1
- (ii) remove solution / liquid (on outside of worm)
allow 'water'
- 1
- (iii) variable amounts removed from each worm
ignore reference to length of timing
- 1
- (iv) equal sizes of worm / more worms (in each group) / wash off all the sand / repeats / use more accurate balance / use smaller concentration intervals
allow reference to improve blotting technique eg blot before / blot more thoroughly
- 1
- (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**
- $$\frac{7.5 \times 100}{37.5} \quad / \quad \frac{7.5}{37.5} \quad / \quad \frac{(45.0 - 1) \times 100}{37.5}$$
- 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]

2

(a) any **two** from:

ignore CO₂ release unqualified

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

or

trees take in CO₂

*do **not** accept CO₂ taken in for respiration*

or

less CO₂ locked up in wood

- CO₂ given off by clearing machinery

2

(b) (i) range of different species

accept idea of variety of organisms or plants or animals

1

(ii) any **two** from:

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

2

[5]

3 (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]

4 (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]

5

(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

ignore number of plants

1

(c) microorganisms / bacteria / fungi / decomposers / detritus feeders / named

1

decompose / rot / break down / decay / digest

ignore feed / eat

1

(these organisms) respire

*do **not** allow respiration by pea (plants)*

1

(decay / respiration / microorganisms etc) releases carbon dioxide

*do **not** allow combustion / fossilisation*

1

[7]

- 6** (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
1 mark for each correct bar
ignore width of bars
- 2
- (ii) 12 800
(16000 / 100)x80 on its own for 1 mark
- 2
- (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]

7 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 reason for deforestation

or

an attempt at a description of at least one way deforestation is affecting the atmosphere.

Level 2 (3 – 4 marks)

There is at least one reason for deforestation

and

a description of the way deforestation is affecting one gas in the atmosphere

or

the process that causes an effect.

Level 3 (5 – 6 marks)

There are reasons for deforestation

and

a clear description of the way deforestation is affecting one gas in the atmosphere

and

the process that causes this.

examples of the points made in the response

Reasons for deforestation

- timber for construction / furniture / boat building / paper production
- growing plants for biofuels for motor fuel / aviation / lawnmowers
- use of wood as a fuel
- land for building or agriculture to provide food, such as rice fields and cattle ranching

Effects of deforestation

- increase in carbon dioxide in atmosphere
due to burning
due to activities of microbes
less carbon dioxide taken in / locked up (by trees)
less photosynthesis
- increase in methane in atmosphere
due to rice production / cattle

extra information

ignore references to oxygen

accept explanations of the effect of water (vapour)

[6]