PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



EXAM QUESTION PACK

TOPIC 10: ECOSYSTEMS

CORE PRACTICALS

SCORE	PERCENTAGE
/91	%

STEMUP

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Q1.

The photograph shows *Galium verum* (Lady's bedstraw), a plant that grows in meadows, hedges, road verges and sand dunes.



(Source: © Alfio Scisetti/Alamy Stock Photo)

This plant grows to between 15 cm and 60 cm in height.

A student investigated whether *Galium verum* growing in meadows was taller than *Galium verum* growing on sand dunes.

(i) Give a suitable null hypothesis for this investigation.

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(ii) Devise a method that can be used to collect valid results to test this null hypothesis.

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(iii) Explain which statistical test would be most suitable to test this null hypothesis.

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(Total for question = 8 marks)

Q2.

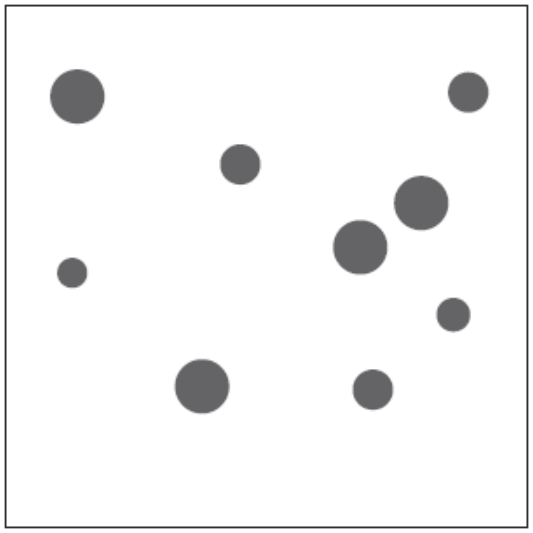
The drawing shows a plant called white clover, *Trifolium repens*.



A student used a 50 cm × 50 cm quadrat to compare the abundance of white clover in a trampled area of grassland and an untrampled area of grassland.

Each area measured 90 m × 45 m.

The diagram shows the distribution of white clover plants in one quadrat from the area of trampled grassland. Each circle represents one clover plant.



(i) Use the results from this quadrat to calculate the total number of white clover plants present in the area of trampled grassland.

(2)

Answer .....

(ii) The student used the same method to calculate the total number of white clover plants in the area of untrampled grassland.

The student decided that the calculated values were not accurate.

Explain how you would modify the method to obtain more accurate results.

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(Total for question = 5 marks)

Q3.

A survey was carried out to compare the biodiversity in different areas of a village.

The photograph shows a children's playing field in this village.



Quadrats placed in the playing field showed predominantly grass with a few dandelion species, ribbed plantains, yarrow and clover. No animal species were observed.

The biodiversity of this playing field was low.

(i) Explain the reasons why the biodiversity of this playing field was low.

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(ii) The photograph shows a path in a woodland nature reserve near the playing field in this village.



After surveying the playing field, a survey of the woodland reserve was carried out using the following method:

- quadrats were placed at various intervals either side of the path
- plant species were counted in the quadrats
- animal species were counted at regular intervals along the path.

The table shows the results of this survey.

	Species	Number
Plant	Dock	10
	Thistle	10
	Hawthorn	6
	Wild cherry	2
	Hazel	5
	Yarrow	5
Animal	Meadow brown butterfly	2
	Shield bug	4
	Beetle	20
	Honeybee	20
	Dragonfly	4
	Spider	5

Calculate the biodiversity index for this woodland nature reserve.

Use the formula

$$D = \frac{N(N-1)}{\Sigma n(n-1)}$$

(3)

Answer .....

(iii) It was suggested that the biodiversity index calculated from this survey was an underestimate.

Criticise the method used in the survey of the woodland nature reserve.

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(Total for question = 12 marks)

Q4.

A student measured the distribution of two plant species at the coast.

The distribution was measured from the high water line to 170 m inland.

The student measured the water content of the soil from the high water line to 170 m inland.

Describe how the student could have carried out these measurements.

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(Total for question = 3 marks)

Q5.

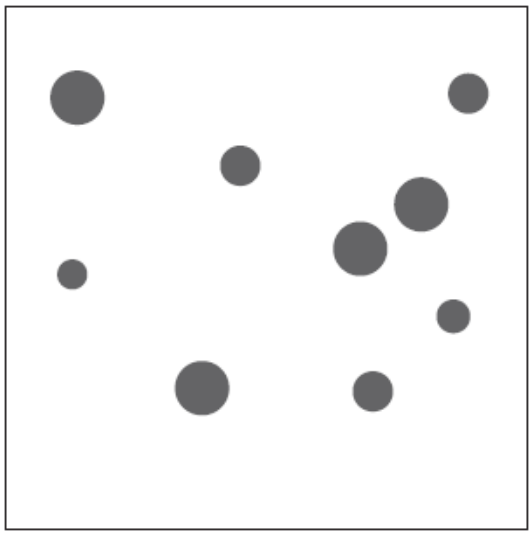
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Each area measured 90 m × 45 m.

The diagram shows the distribution of white clover plants in one quadrat from the area of trampled grassland. Each circle represents one clover plant.



The student investigated the effect of one abiotic factor on the abundance of white clover plants.

(i) Name one abiotic factor, other than soil water content, that could affect the abundance of white clover plants in these areas.

(1)

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(ii) Describe how you would measure the abiotic factor named in part (i).

(2)

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(iii) The student obtained the following results for soil water content and the abundance of white clover plants in these two areas of grassland.

Area of grassland	Soil water content (%)	Abundance of white clover plants
Trampled	54.9	low
Untrampled	88.8	high

Explain the effect of trampling on the abundance of white clover plants.

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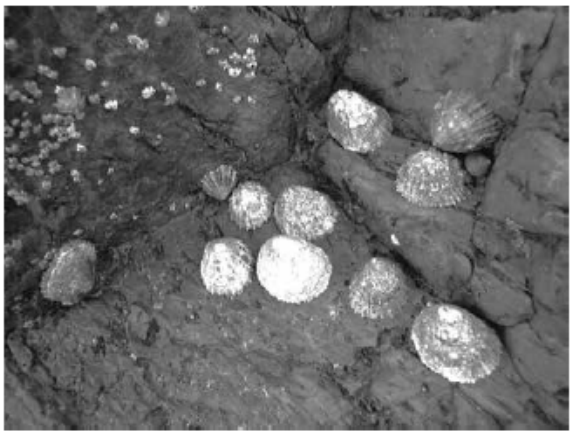
(Total for question = 5 marks)

Q6.

The photograph below shows limpets *Patella vulgata* living on a rocky seashore.

Limpets are snail-like animals with a conical shell. The limpets live on a part of the shore which is covered by the sea twice each day. They feed on algae when the rocks are covered with sea water.

When they are uncovered at low tide they clamp against the rock to prevent desiccation.



A student investigated the relationship between the size of the limpets and their location on the shore.

A 40 m transect was used, beginning at the low water mark and extending up a sloping rocky shore. A $1m^2$ quadrat was placed every 5 m along this transect and the diameter of 10 randomly selected limpets was measured.

The table below shows data collected from this investigation.

Distance from low water mark / m	Rank of distance	Mean diameter of limpets / mm	Rank of diameters	Difference in the two ranks (D)	D^2
0	9	19.8	3	6	36
5	8	20.2	1	7	49
10	7	19.6	4	3	9
15	6	18.8	5	1	1
20	5	20.1	2	3	9
25	4	17.4	6	−2	4
30	3	16.1			
35	2	16.9	8	−6	36
40	1	17.2			

(a) Complete the table to show the missing data.

(2)

(b) (i) To test the strength of the relationship between these two variables, the student decided to apply a Spearman's rank correlation test.

Calculate the Spearman's rank correlation coefficient for these two variables.

(3)

$$r_s = 1 - \frac{6(\Sigma D^2)}{n(n^2 - 1)}$$

Answer .....

(ii) A student formed the hypothesis that the size of the limpets would decrease as the distance up the shore increased.

The table below shows critical values of r_s at different significance levels.

Number of pairs	Significance levels			
	10%	5%	2%	1%
8	0.643	0.786	0.833	0.881
9	0.600	0.683	0.783	0.833
10	0.564	0.648	0.746	0.794

Use the calculated value of r_s and this table to comment on whether the student's hypothesis can be accepted.

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(c) The student carrying out the investigation wrote a further hypothesis:

'*The limpets lower on the shore have a longer time to feed and will grow bigger.*'

Design a laboratory experiment to test this hypothesis.

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(Total for question = 13 marks)

Q7.

Sea plantain and bog sedge grow at a range of latitudes. A student carried out an investigation into the effect of temperature on the growth of seedlings of these two species.

Sets of seeds from each species were germinated at 18 °C. As soon as they germinated, the seedlings were placed in three temperature-controlled rooms at 10 °C, 14 °C and 18 °C.

They were allowed to grow for 50 days. Samples of seedlings were taken at 10-day intervals and their mean dry masses were recorded.

The results of this investigation are shown in the tables below.

Table 1 – Sea plantain

Day	Mean dry mass / mg		
	10 °C	14 °C	18 °C
10	3	4	6
20	7	12	20
30	13	25	47
40	20	40	109
50	28	80	210

Table 2 – Bog sedge

Day	Mean dry mass / mg		
	10 °C	14 °C	18 °C
10	1	1	1
20	1	2	2
30	2	3	5
40	3	5	12
50	5	7	22

Analyse the data to explain which of the two species is better for growth at a wider range of latitudes (distance from the equator).

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(Total for question = 4 marks)

Q8.

The photograph shows a wood mouse, *Apodemus sylvaticus*.



(Source: © Eric Isselee/Shutterstock)

A scientist measured the population size of these mice living in a woodland habitat.

The scientist used the capture-mark-recapture method (CMR) to sample the population.

This is the CMR method used by the scientist:

- randomly place mammal traps in the woodland for one day
- put a coloured band on a leg of each captured mouse (S1)
- release these marked mice
- after one week place mammal traps in the woodland again for one day
- count the number of mice captured (S2)
- count the number of mice with leg bands in this second sample (L).

Comment on the claim that the CMR method produces an accurate measure of the population size of mice in the woodland.

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(Total for question = 5 marks)

Q9.

The photograph shows a wood mouse, *Apodemus sylvaticus*.



(Source: © Eric Isselee/Shutterstock)

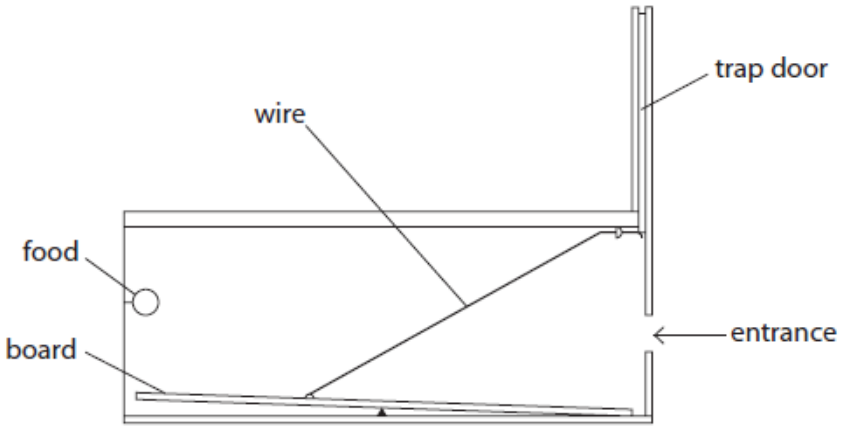
A scientist measured the population size of these mice living in a woodland habitat.

The scientist used the capture-mark-recapture method (CMR) to sample the population.

This is the CMR method used by the scientist:

- randomly place mammal traps in the woodland for one day
- put a coloured band on a leg of each captured mouse (S1)
- release these marked mice
- after one week place mammal traps in the woodland again for one day
- count the number of mice captured (S2)
- count the number of mice with leg bands in this second sample (L).

The diagram shows a section of the trap used by the scientist.



Explain how the design of the trap is effective for capturing mice.

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(Total for question = 3 marks)

Q10.

The photograph shows *Salicornia*, a plant growing on salt marshes close to the sea. *Salicornia* colonises bare mud containing seawater.



A student sampled *Salicornia* plants at the river mouth by the sea and at different distances upstream. Samples of the water in the mud were also taken.

The salt concentration of the plants and the water in the mud were measured.

The results are shown in the table.

Distance upstream from sea / km	Salt concentration / arbitrary units	
	Salicornia plants	Water in the mud
0.0	60.0	2.8
1.6	60.0	1.1
4.8	55.0	0.6
8.0	75.0	0.2

Analyse the data to explain how *Salicornia* is adapted to life in salt marshes.

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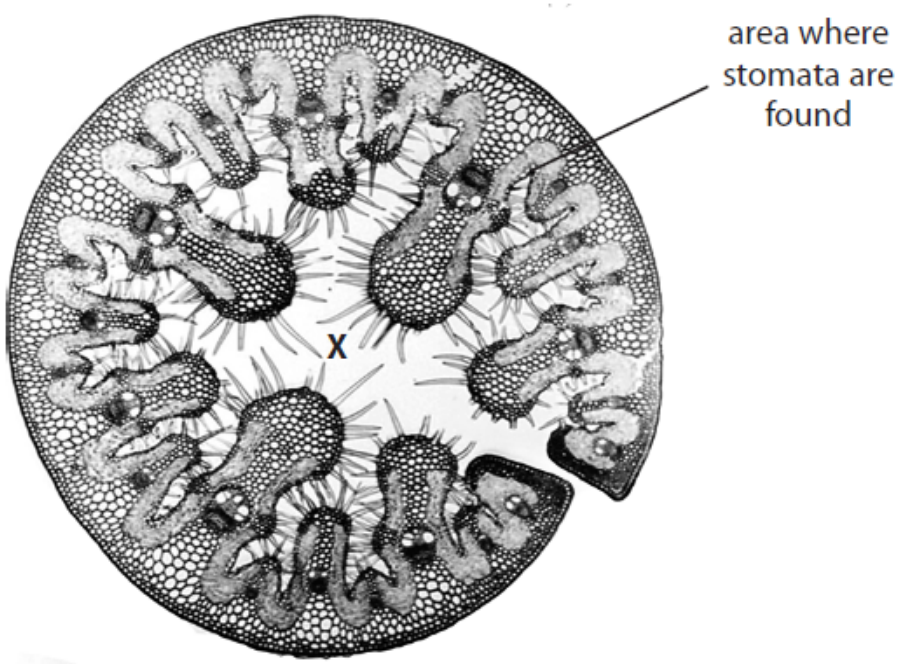
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(Total for question = 3 marks)

Q11.

Marram grass leaves are adapted to enable the plants to survive in dry soil.

The photograph shows a section of a marram grass leaf, as seen using a light microscope.



Explain how the structure of this leaf ensures that the water potential at X remains high.

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(Total for question = 3 marks)

Q12.

Photosynthetic pigments are found in plant leaves.

A scientist investigated the effect of lead pollution by cars on the chlorophyll content of plant leaves.

Quadrat sampling was used to collect leaves from a plant species.

Leaf samples were collected from an area with little car traffic and from an area with heavy car traffic.

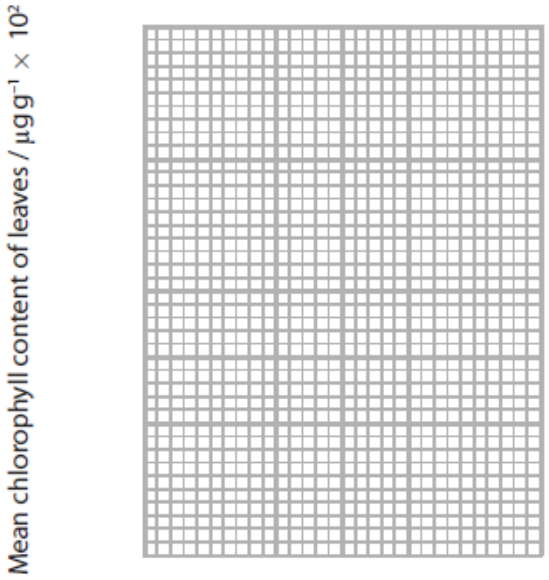
The leaf samples were tested for lead content and chlorophyll content.

The table shows the results of this investigation.

Area	Mean lead content of leaves / $\mu g\,g^{-1}$	Mean chlorophyll content of leaves / $\mu g\,g^{-1} \times 10^2$
Little traffic	1.28 ± 0.64	64.00 ± 4.00
Heavy traffic	3.11 ± 0.31	22.50 ± 3.00

(i) Plot a graph to show the data for mean chlorophyll content.

(2)



(ii) Explain how the quadrat sampling should have been carried out.

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(iii) The scientist concluded that lead pollution from cars reduces the photosynthesis of plants.

Criticise the validity of this conclusion.

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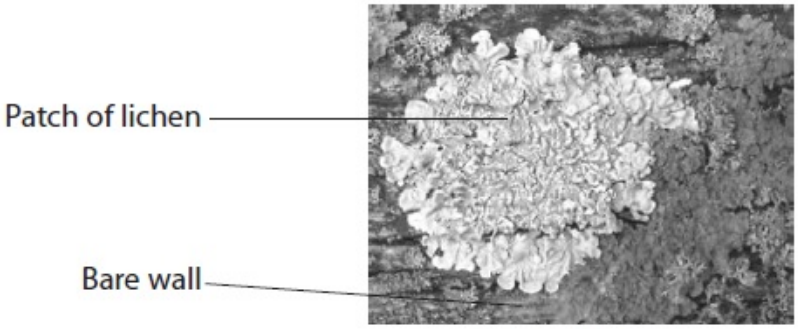
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(Total for question = 7 marks)

Q13. Lichen consists of two organisms, an alga and a fungus, growing together. The alga photosynthesises producing carbohydrate for the two organisms and the fungus absorbs and retains water so that the lichen does not dry out.

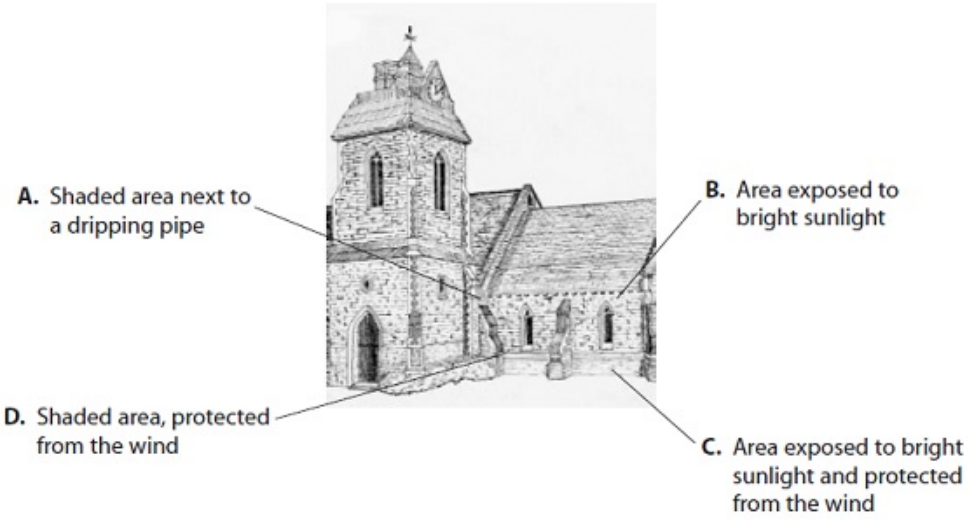
The photograph below shows a patch of lichen growing on a wall.



Magnification ×1

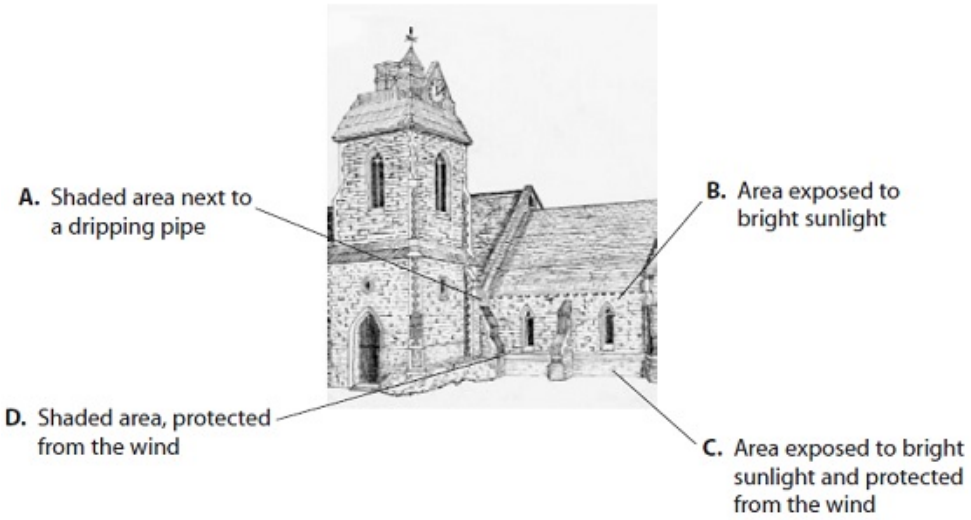
Algae and fungi are eukaryotic organisms.

(a) Place a cross

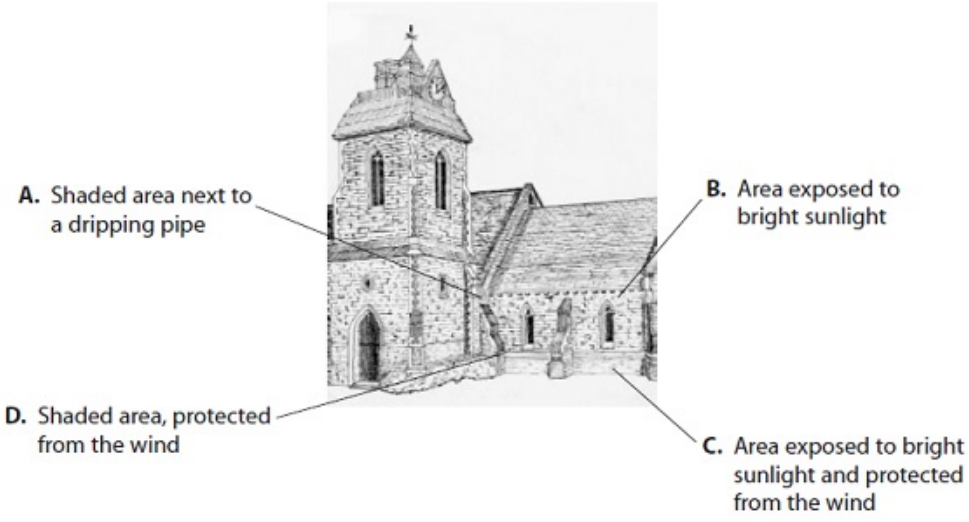


in the box next to the names of cell structures that would be used to classify algae and fungi as eukaryotic organisms.

(1)

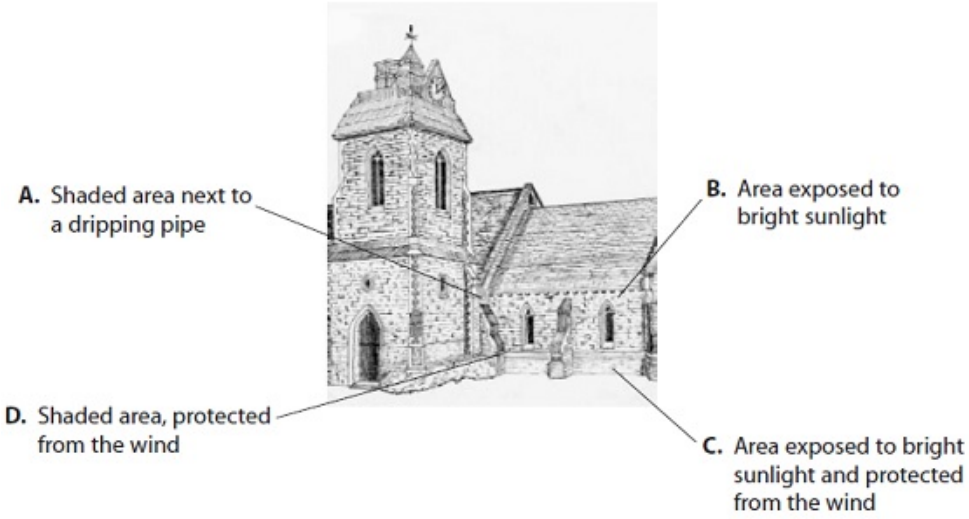


A cytoplasm and large (80S) ribosomes



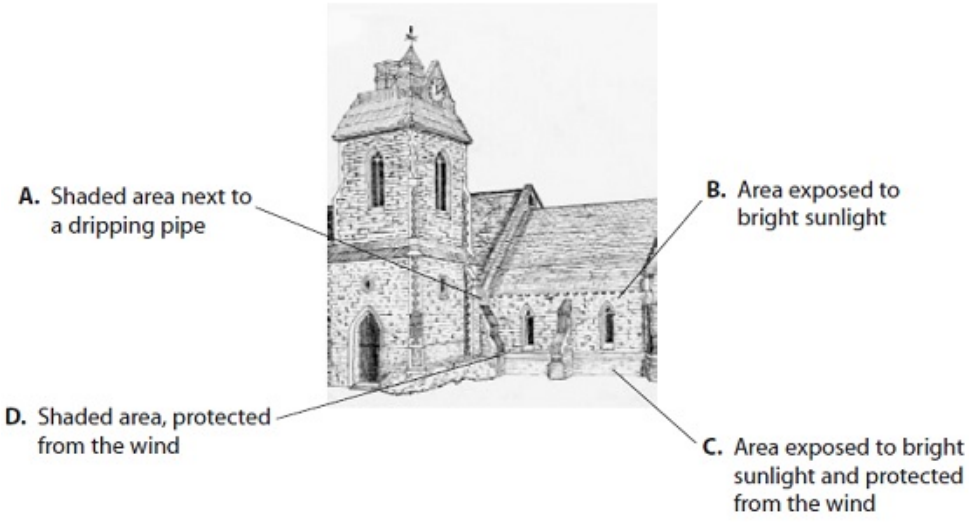
(70S) ribosomes

B cytoplasm and small



ribosomes

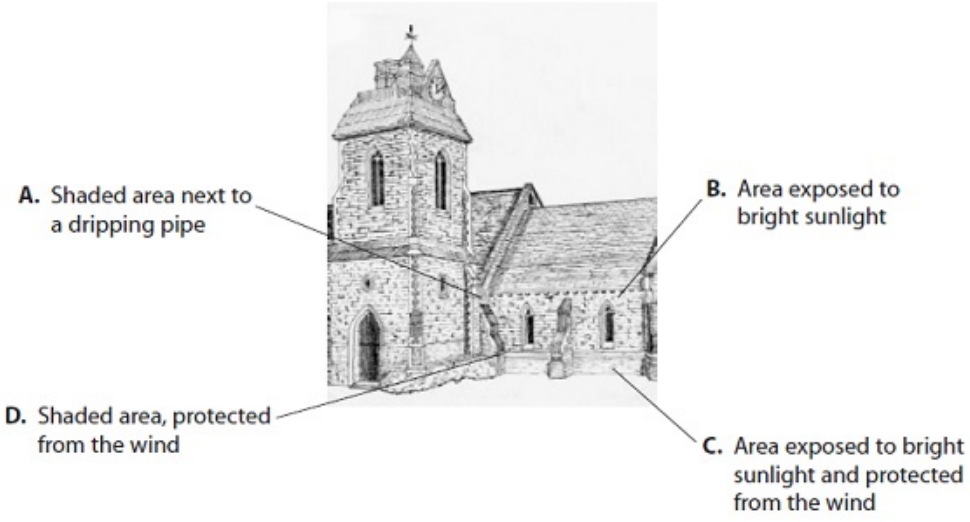
C nucleus and large (80S)



ribosomes

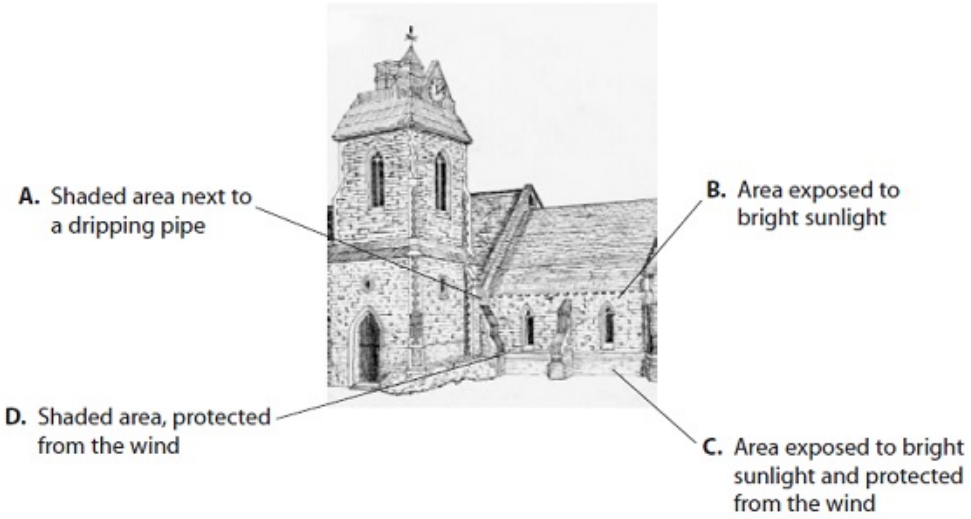
D nucleus and small (70S)

(b) Place a cross

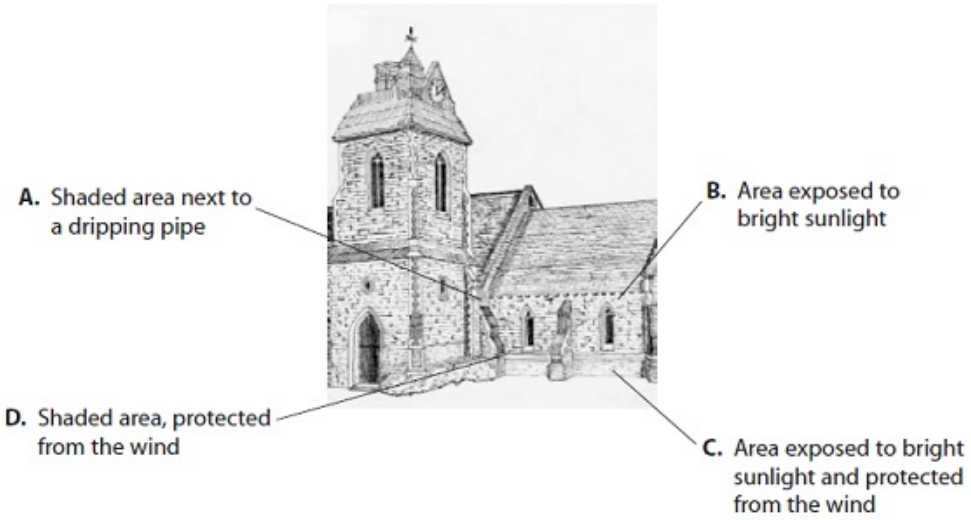


in the box next to one difference in cell structure between these two eukaryotic organisms.

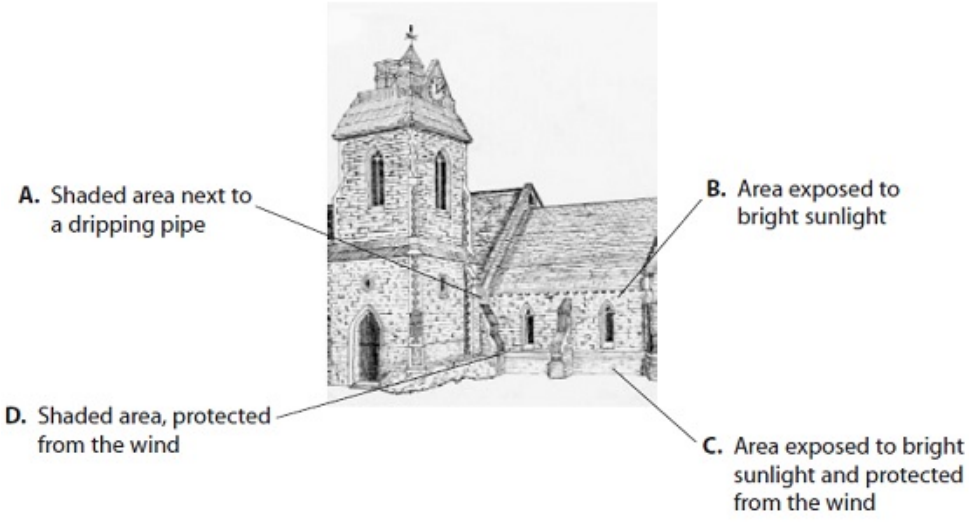
(1)



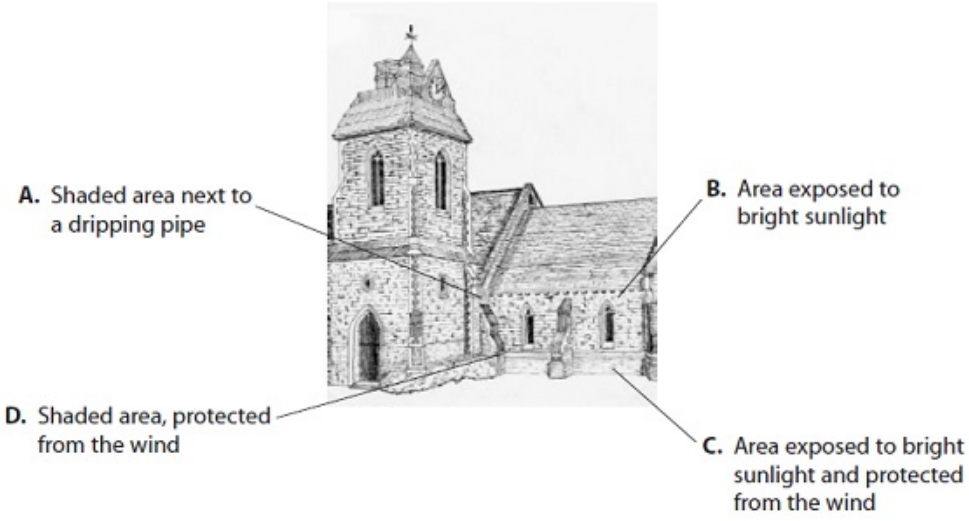
A algae have chloroplasts, fungi do not



B algae have circular DNA, fungi have linear DNA



C fungi have chloroplasts, algae do not



D fungi have circular DNA, algae have linear DNA

(c) Lichens can reproduce sexually and asexually. Sexual reproduction involves meiosis and asexual reproduction involves mitosis.

Suggest advantages to lichens of being able to reproduce both sexually and asexually.

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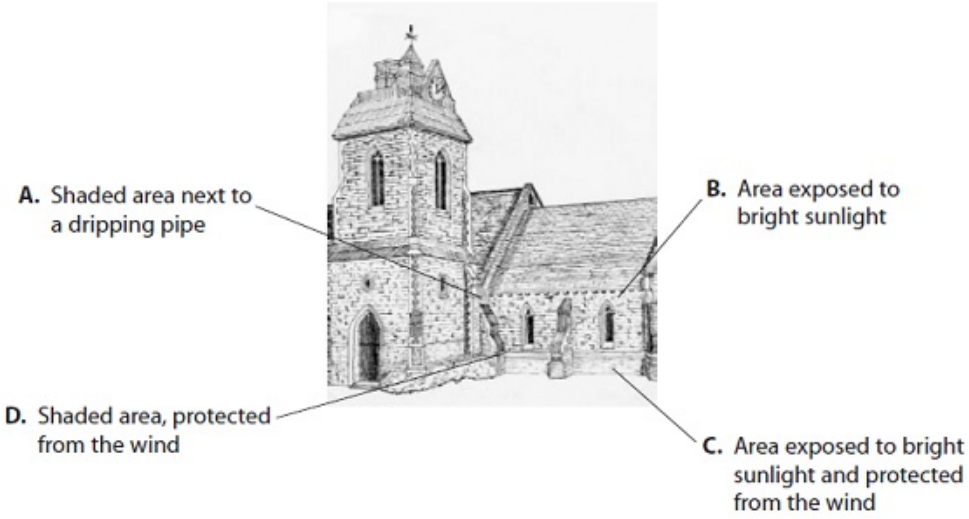
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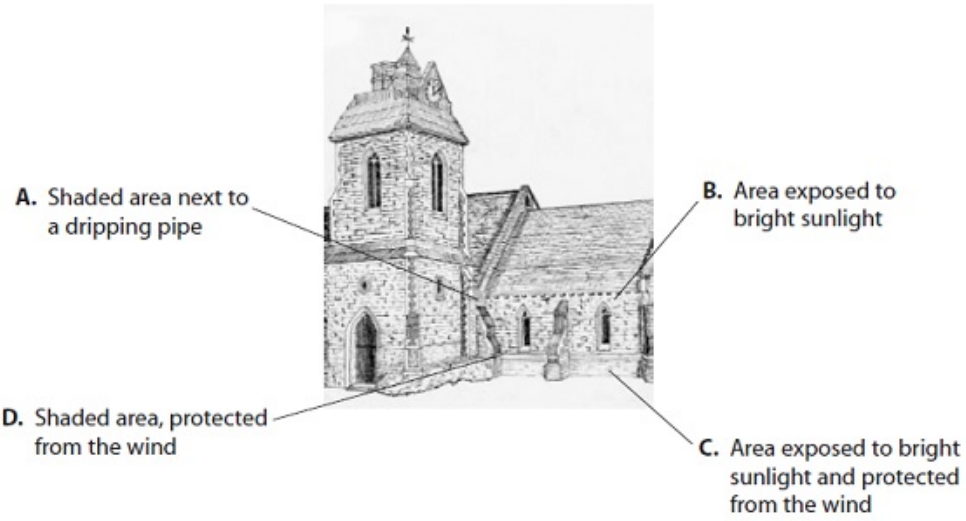
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(d) The diagram below shows the conditions at four positions, A, B, C and D, on a building.

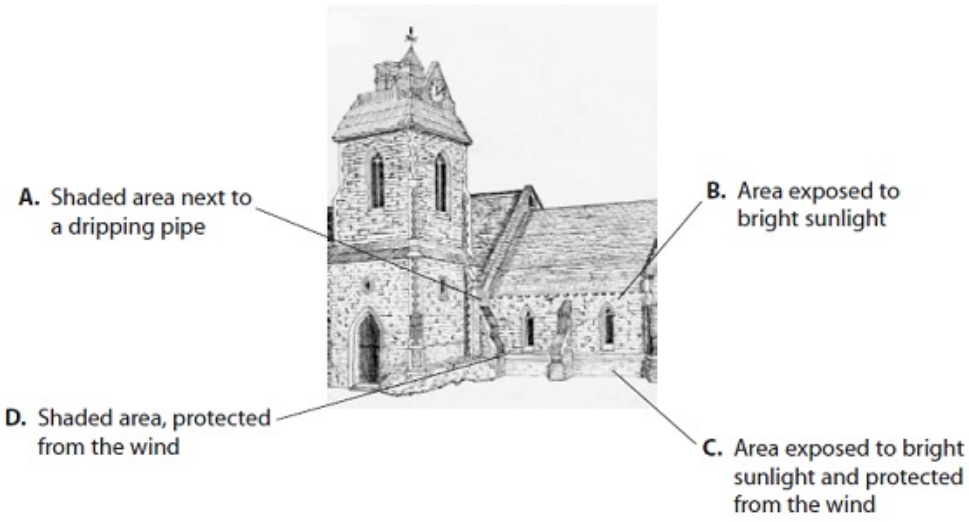


(i) Place a cross

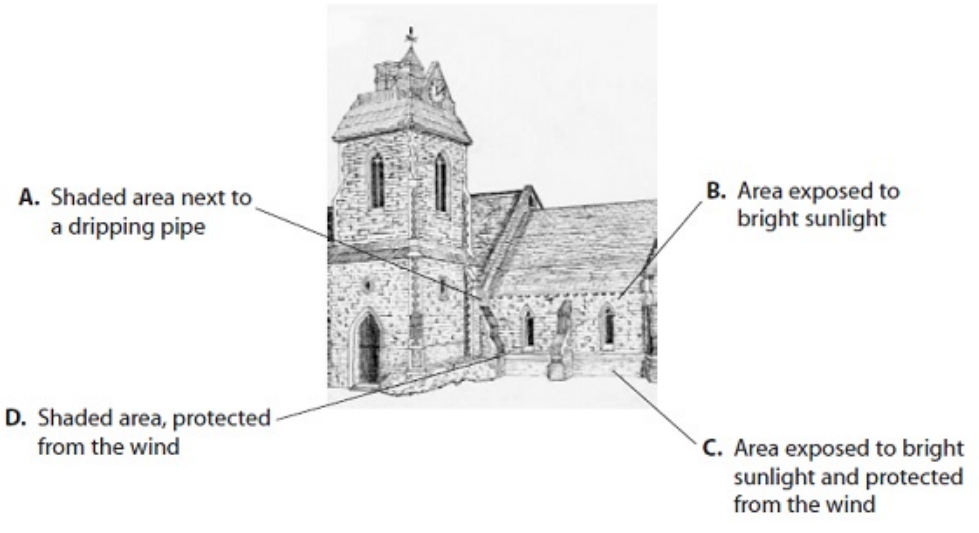


in the box next to the position where the lichen is likely to be most abundant.

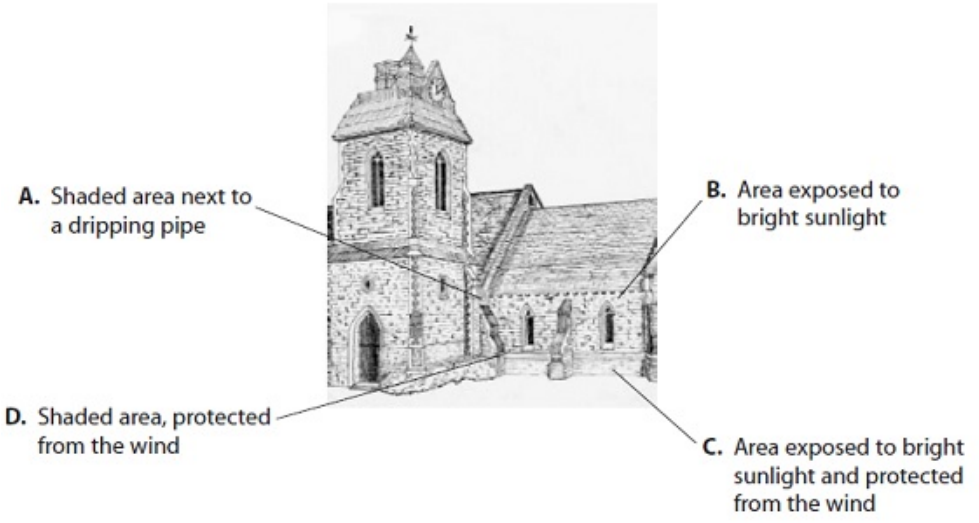
(1)



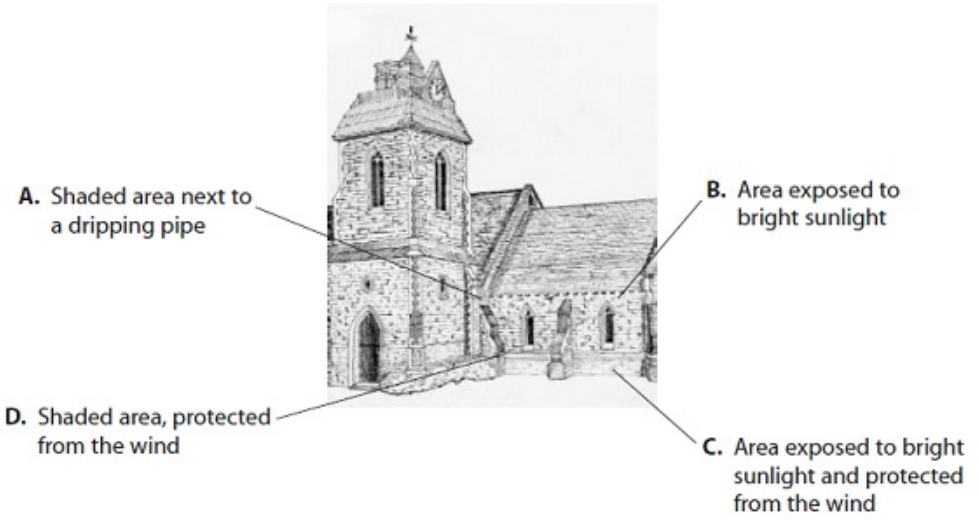
A



B



C



D

(ii) The abundance of lichen on the walls of this building can be measured by determining the percentage cover of lichen.

Suggest how the percentage cover of lichen could be determined.

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(iii) Explain how light intensity could be measured at the surface of the wall.

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(iv) Suggest how the data collected could be used to show whether there is a relationship between the abundance of lichen and light intensity.

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(Total for Question = 13 marks)

Q14.

The photograph shows a wood mouse, *Apodemus sylvaticus*.



(Source: © Eric Isselee/Shutterstock)

A scientist measured the population size of these mice living in a woodland habitat.

The scientist used the capture-mark-recapture method (CMR) to sample the population.

This is the CMR method used by the scientist:

- randomly place mammal traps in the woodland for one day
- put a coloured band on a leg of each captured mouse (S1)
- release these marked mice
- after one week place mammal traps in the woodland again for one day
- count the number of mice captured (S2)
- count the number of mice with leg bands in this second sample (L).

The table shows some of the results.

Number of mice captured	
S1	S2
200	250

The scientist calculated that the number of mice in the woodland was 1000, using the formula

$$\text{number of mice} = \frac{S1 \times S2}{L}$$

Determine the number of mice that had leg bands (L) in the second sample.

(1)

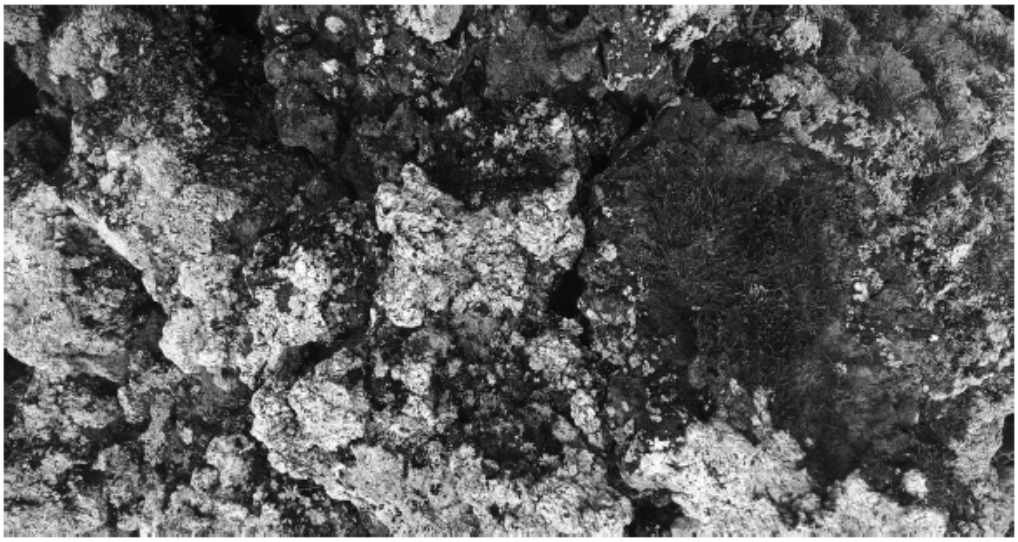
Answer .....

(Total for question = 1 mark)

Q15.

Lanzarote is a volcanic island in the Atlantic Ocean. It lies near the coast of West Africa.

The photograph shows lichens growing on volcanic rock in Lanzarote.



Lichens are organisms composed of a fungus and algae living together.

Lichens colonise bare rock.

Devise an investigation to show how the lichen distribution is affected by a named abiotic factor.

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(Total for question = 6 marks)