

PEARSON EDEXCEL A-LEVEL BIOLOGY B • 9B10

BIOLOGY



EXAM QUESTION PACK

TOPIC 10: ECOSYSTEMS
CORE PRACTICALS

SCORE

/91

PERCENTAGE

%

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.

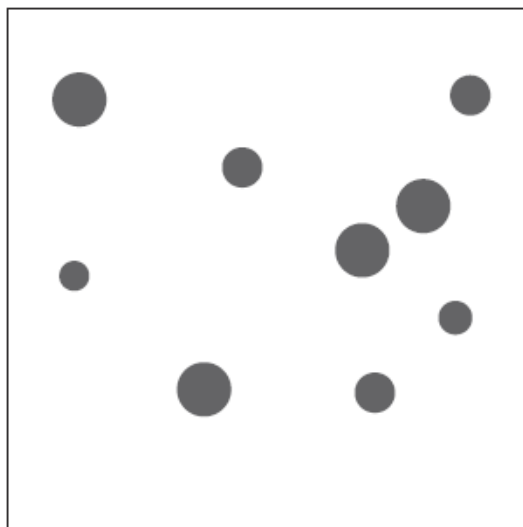
The drawing shows a plant called white clover, *Trifolium repens*.



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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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.

(3)

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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

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

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)

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.

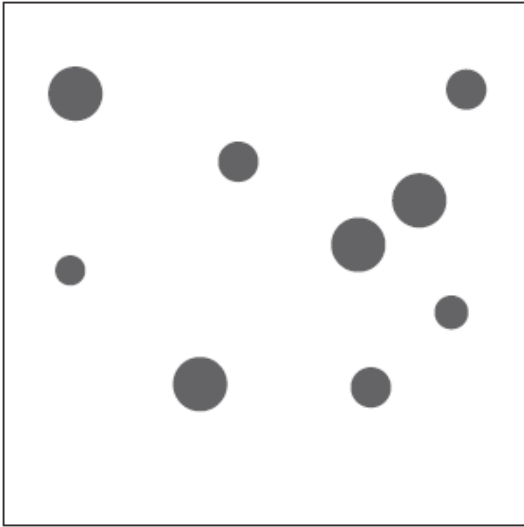
The drawing shows a plant called white clover, *Trifolium repens*.



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.



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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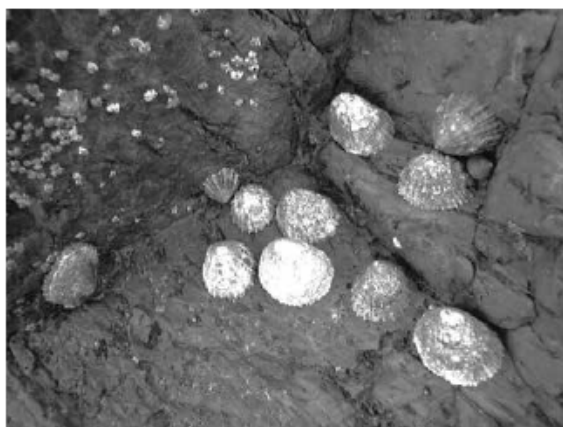
(Total for question = 5 marks)

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 1m² 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)

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

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)

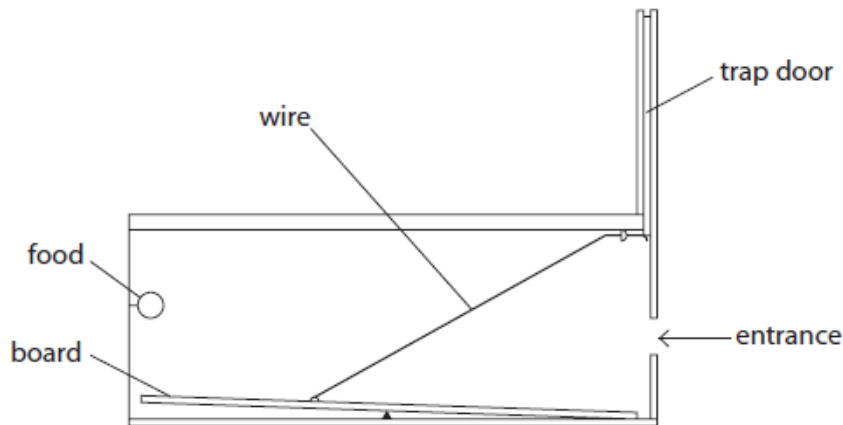
A scientist measured the population size of these mice living in a woodland habitat.

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	
	<i>Salicornia</i> 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.

(3)

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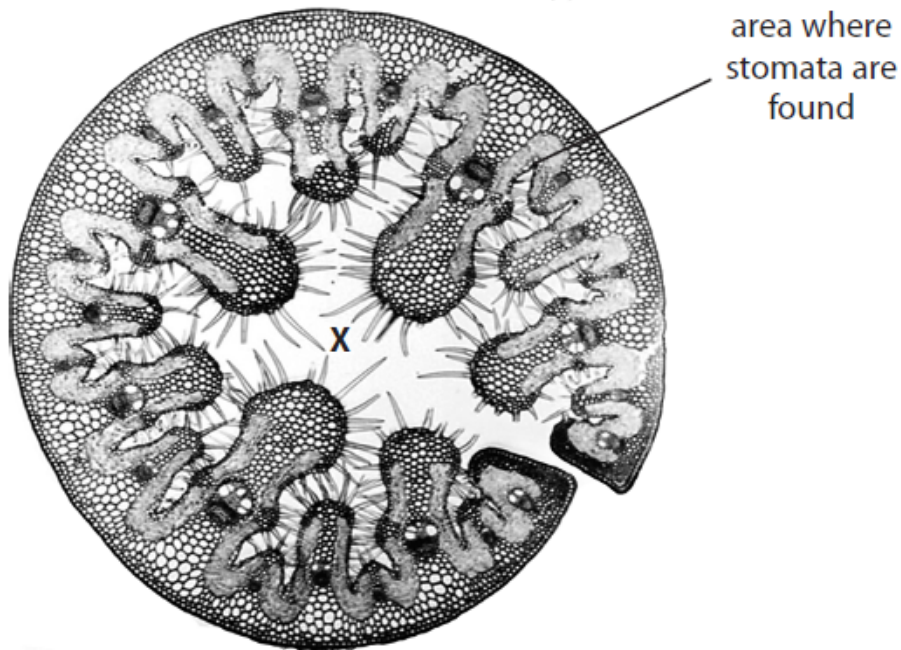
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(Total for question = 3 marks)

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.

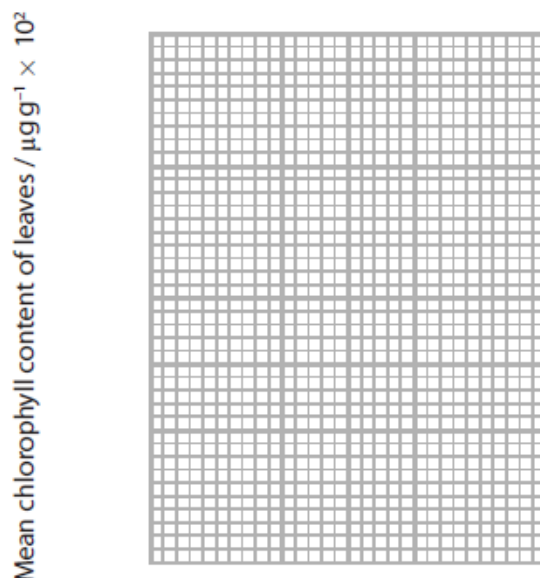
The leaf samples were tested for lead content and chlorophyll content.

The table shows the results of this investigation.

Area	Mean lead content of leaves / $\mu\text{g g}^{-1}$	Mean chlorophyll content of leaves / $\mu\text{g g}^{-1} \times 10^2$
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.

(3)

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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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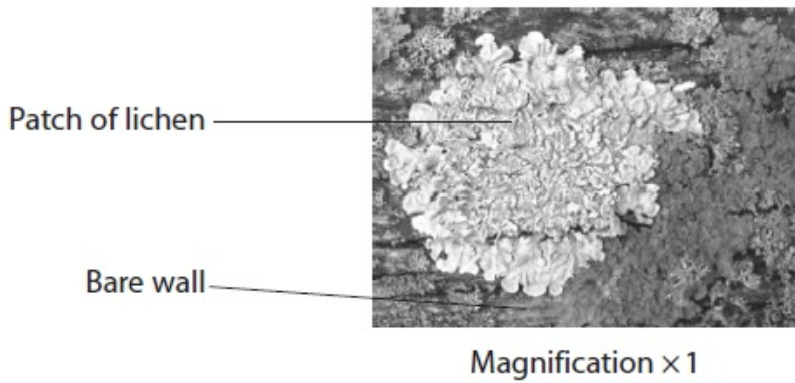
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(Total for question = 7 marks)

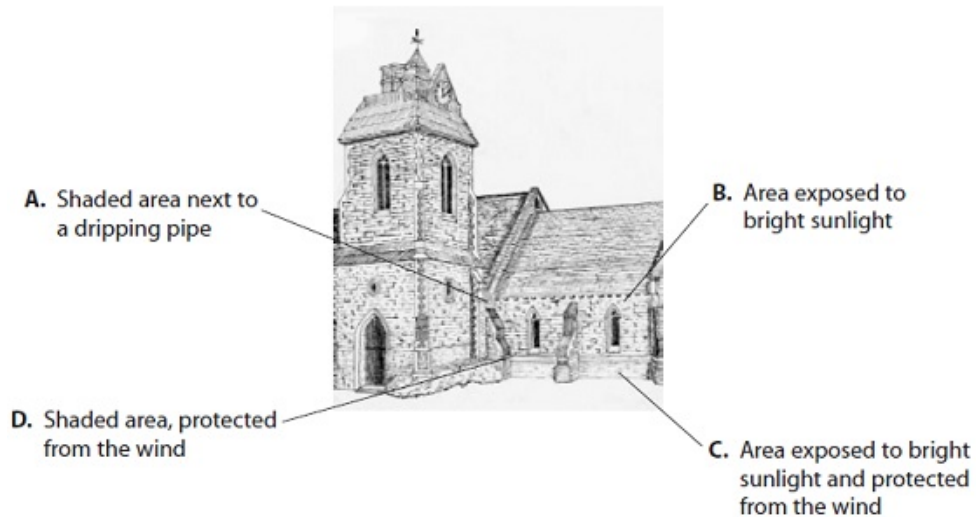
Q13. Lichen consists of two organisms, an alga and a fungus, growing together. The alga photosynthesises producing carbohydrate for the two organisms and the fungus absorbs and retains water so that the lichen does not dry out.

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



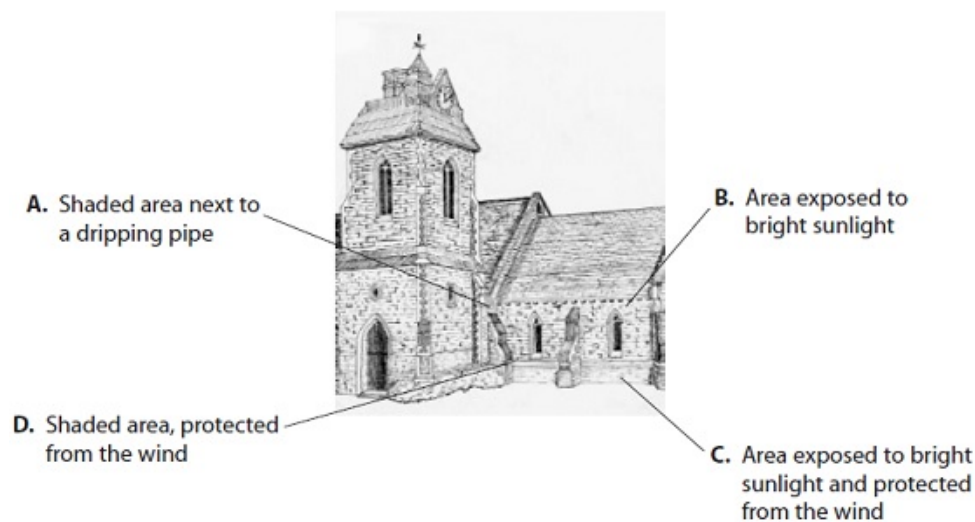
Algae and fungi are eukaryotic organisms.

(a) Place a cross



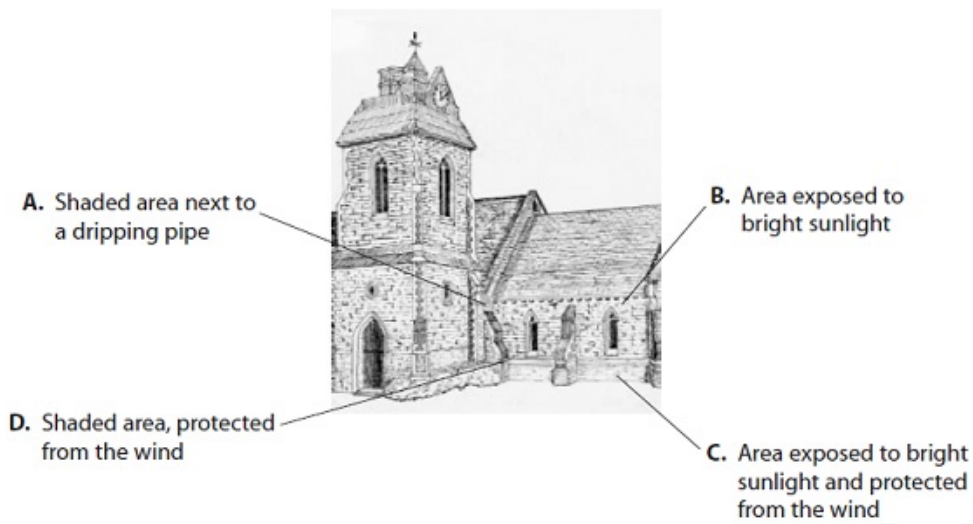
in the box next to the names of cell structures that would be used to classify algae and fungi as eukaryotic organisms.

(1)



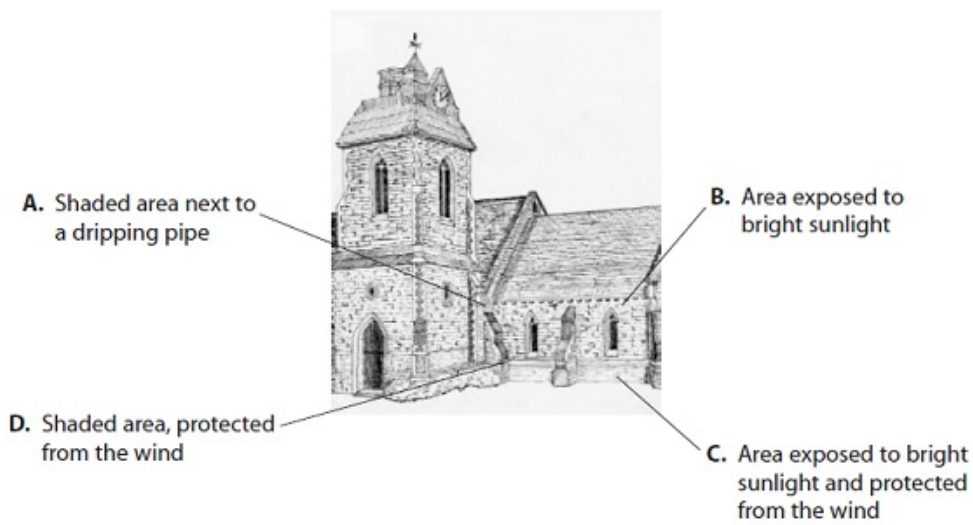
(80S) ribosomes

A cytoplasm and large



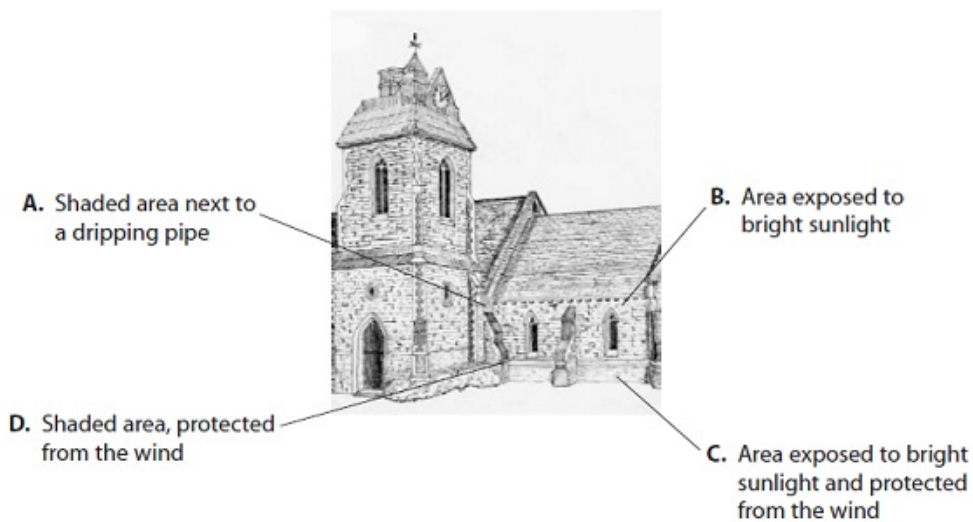
B cytoplasm and small

(70S) ribosomes



C nucleus and large (80S)

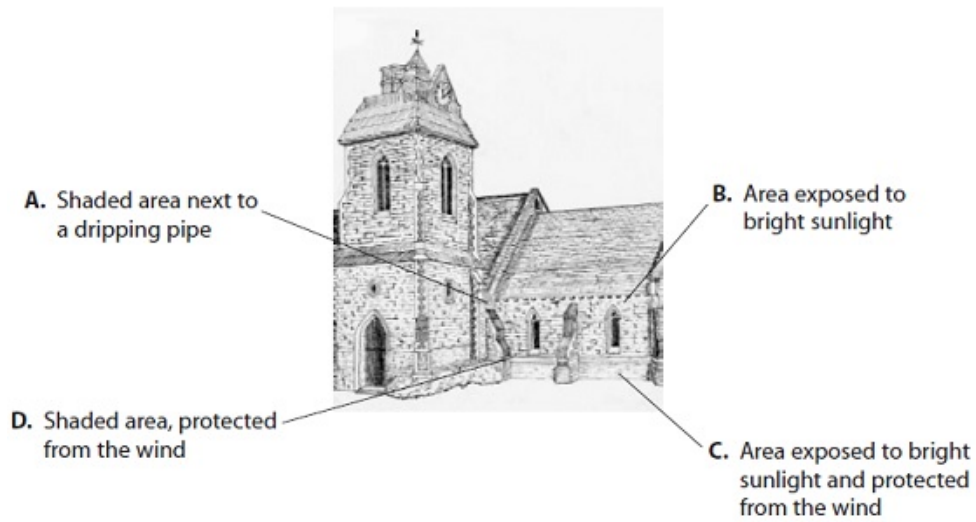
ribosomes



D nucleus and small (70S)

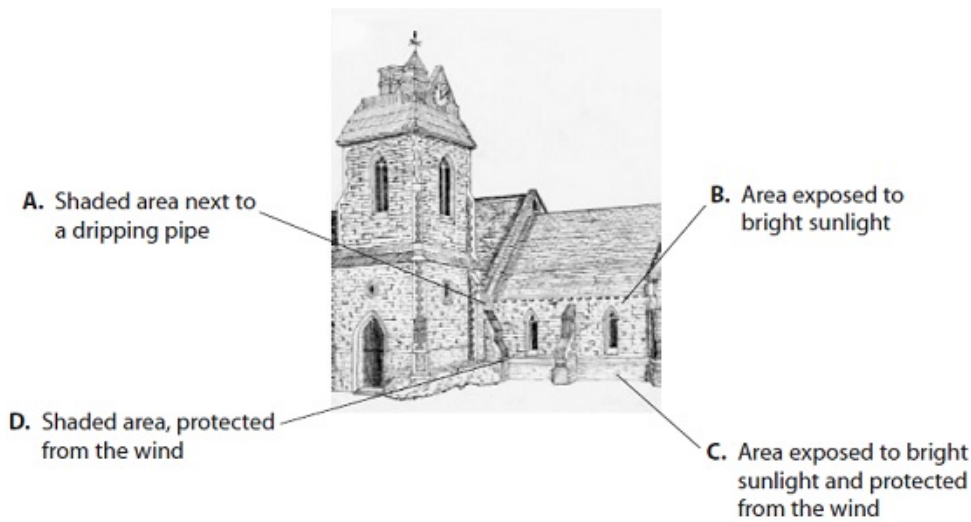
ribosomes

(b) Place a cross



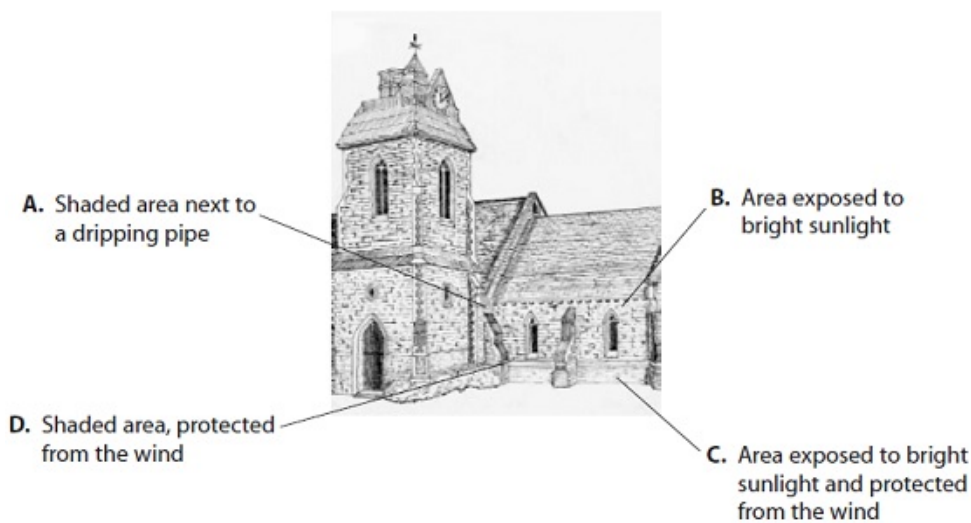
next to one difference in cell structure between these two eukaryotic organisms.

(1)



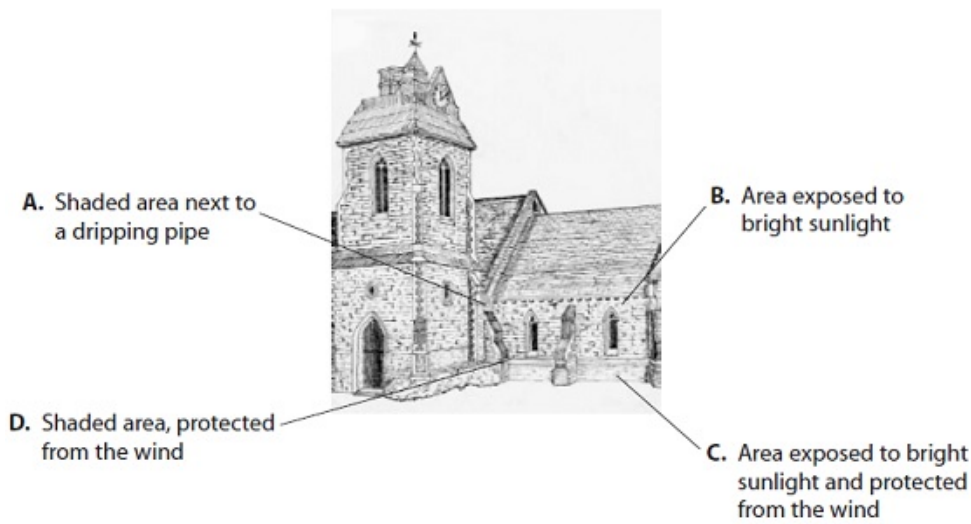
fungi do not

A algae have chloroplasts,



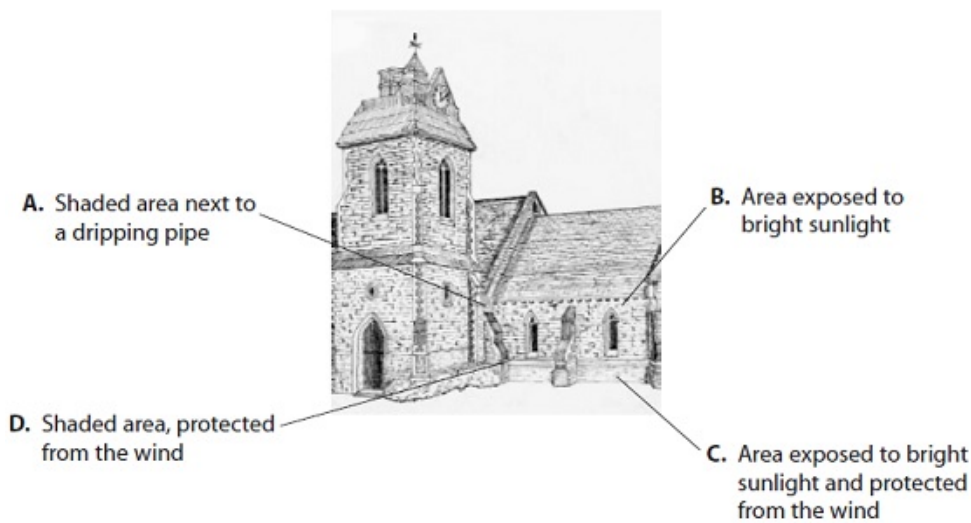
fungi have linear DNA

B algae have circular 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.

(2)

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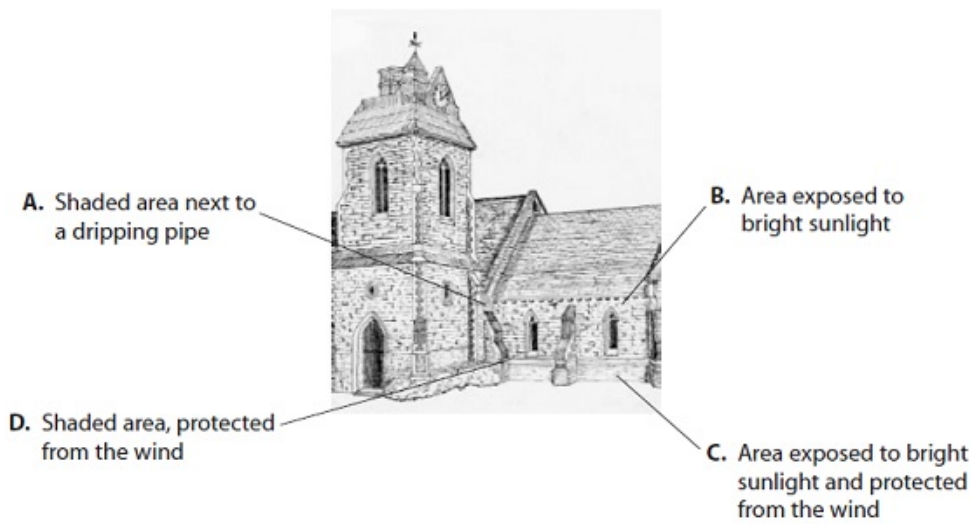
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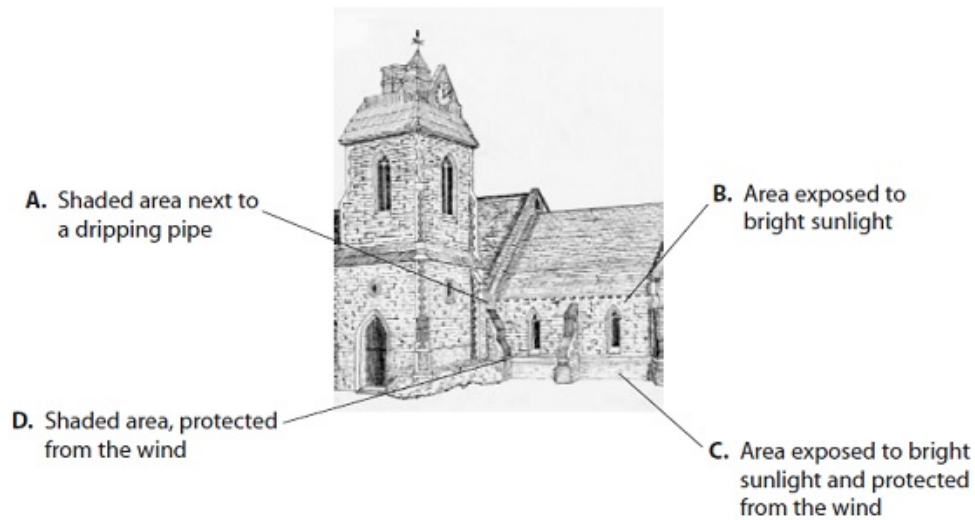
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(d) The diagram below shows the conditions at four positions, A, B, C and D, on a building.

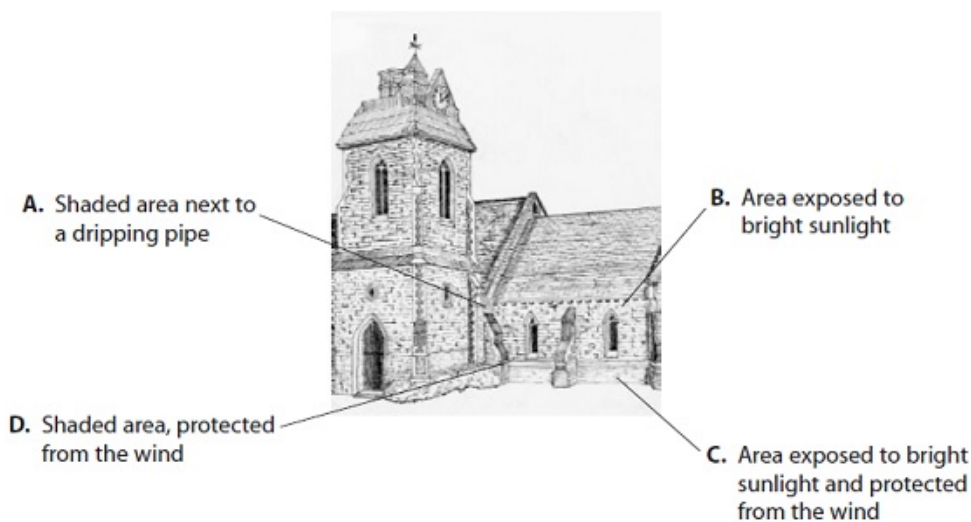


(i) Place a cross

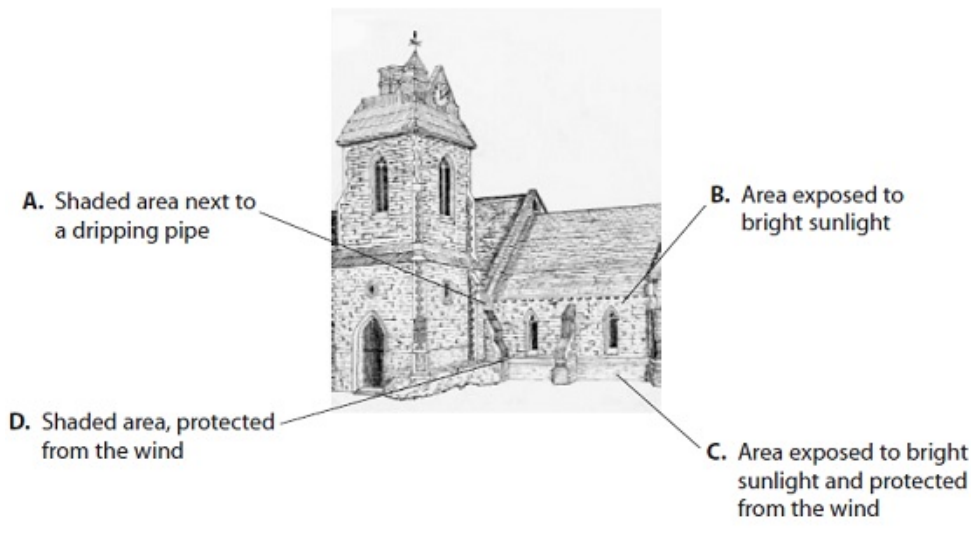
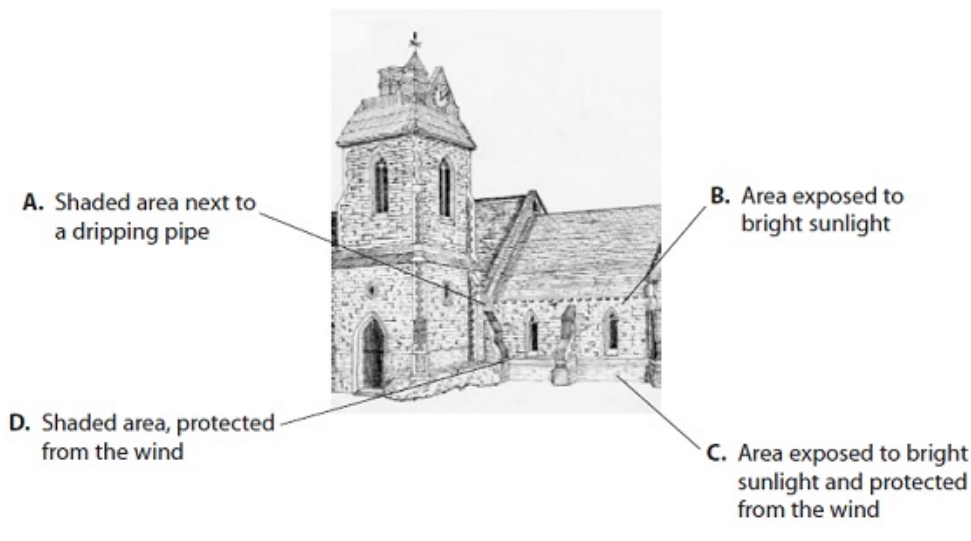
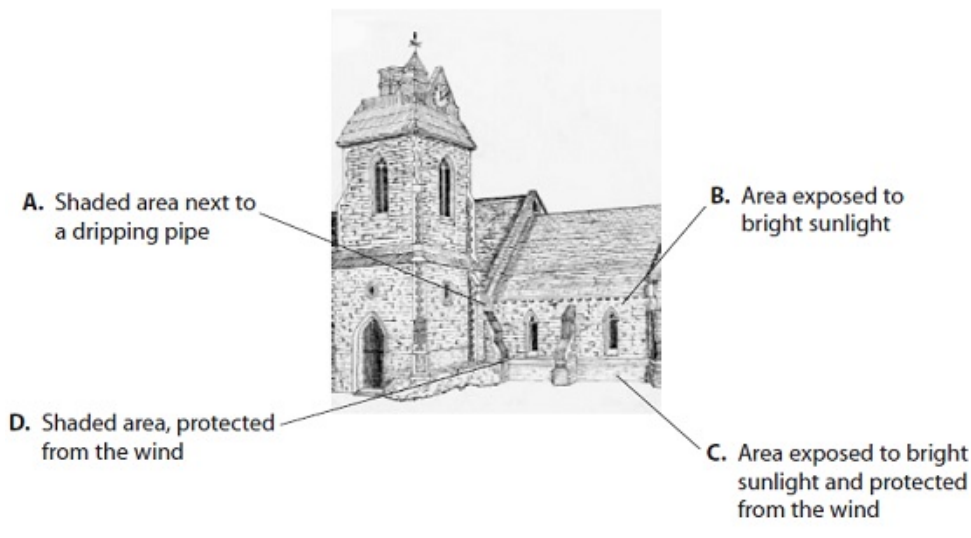


next to the position where the lichen is likely to be most abundant. in the box

(1)



A



(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)

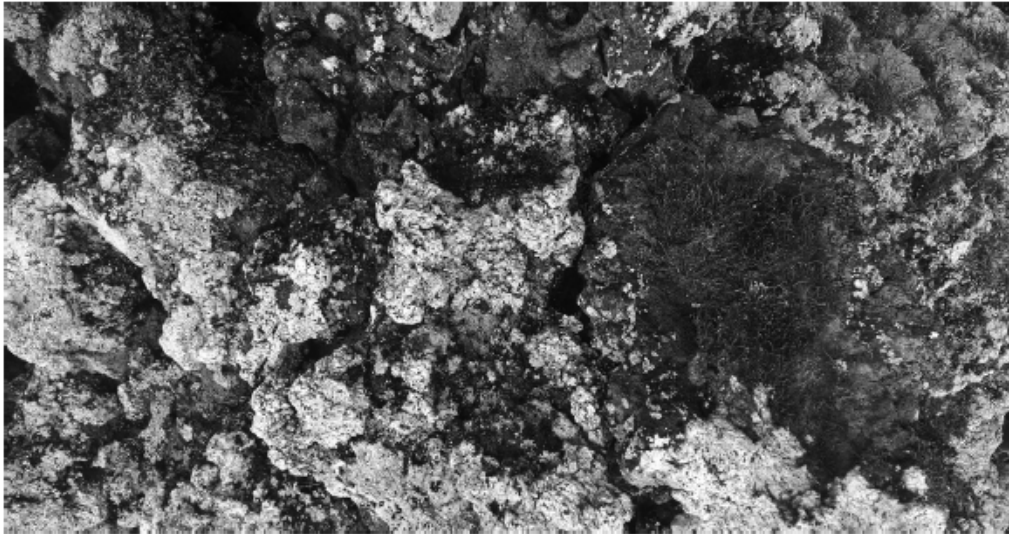
Answer

(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)

Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
(i)	there is no difference in the (mean) height of <i>Galium verum</i> growing in meadow and dunes (1)	Accept reference to no significant difference in the (mean) height of <i>Galium verum</i> growing in meadow and dunes	Exp (1)

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer that includes the following: • use of random numbers to select sampling site (1) • use of (frame or point) quadrat (to define sampling area) in meadow and dune (1) • measurement of height of <i>Galium verum</i> (1) • large sample size or use of running mean (1) • attempt to {control / measure} named variable (1)	Accept description of setting up grid and using co-ordinates for random sampling Accept closest plant to point selected in meadow and dune eg at least 10 plants in each place eg shading / slope / grazing / trampling / time of year / rainfall / use of herbicide Ignore soil type / pH / time of day	Exp (5)

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation that includes the following points • t-test (1) • (because it) tests for the difference between the means of two sets of values (1)	Accept other suitable test eg Mann Whitney U test Accept it tests for a (significant) difference between two sample sets	Exp (2)

Q2.

Question Number	Answer	Additional Guidance	Mark
(i)	- calculate the area of quadrat and calculate the area of grassland to calculate the number of quadrats in grassland (1) - multiply number of quadrats in area of grassland by number of clover (1) Or - number of clover plants per m² (1) - multiply by total area of grassland in m² (1)	<u>Example of calculation</u> $50 \times 50 = 2500 \text{ cm}^2 / 0.25 \text{ m}^2 \text{ and}$ $90 \times 45 = 4050 \text{ m}^2$ $4050 \times 4 = 16200$ $16200 \times 9 = 145800$ $9 \times 4 = 36$ $36 \times (90 \times 45) = 145800$ Correct answer with no working gains full marks	(2)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to three of the following: - use {several quadrats / larger quadrat} (1) - therefore larger area sampled (1) - place quadrats at random / use random number generation (1) - therefore achieve a consistent measure of the mean (1)	Accept use of running mean	(3)

Q3.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to three of the following: • (biodiversity is low) because there are few species (1) • because there is a lot of trampling (1) • because animals are disturbed (by noise) (1) • because grass is mown (makes it difficult for other species to establish themselves) (1)		(3)
(ii)	An answer that makes reference to the following: • calculation of $N(N-1)$ (1) • calculation of sum of $n(n-1)$ (1) • calculation of D (1)	Example calculation 8556 1058 8.1 / 8.09 / 8.087 Correct answer with no working gains full marks	(3)

Question Number	Answer	Additional Guidance	Mark
(iii)	An answer that makes reference to six of the following: • quadrats not placed at random (1) • {size / number} of quadrats not mentioned (1) • plants sampled at various intervals, animals at regular intervals (1) • {animals observed / no mention of how animals are counted} (1) • animals may {hide / move away / be counted twice} (1) • {only path sampled / inner area of woodland not sampled} (1) • not all animals identified to species level (1) • survey done at only one {time of year / time of day} (1)	Allow size of sample area not mentioned Allow description of pitfall traps, sweepnets, mark release recapture etc. could be used	(6)

Q4.

Question Number	Answer	Additional Guidance	Mark
	A description that makes reference to the following: - sample at intervals along transect / sample from same place in quadrat (1) - weighing, drying and reweighing (1) - constant mass (1) OR - sample at intervals along transect / sample from same place in quadrat (1) - insert probe into the soil (1) - at same {depth / length of time}	DO NOT ACCEPT burning	(3)

Q5.

Question Number	Answer	Additional Guidance	Mark
(i)	An answer that makes reference to the following: named abiotic factor	e.g. light / temperature / pH / named mineral / salinity / wind	(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	A description that makes reference to the following: - apparatus (1) - measure {by clover plants / in each quadrat / in same place / at same time of day} (1)		(2)

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation that makes reference to two of the following: - trampled soil has less {water / air / oxygen} (1) - therefore {photosynthesis / respiration / absorption of mineral ions} affected (1) - physical damage to plants / competition from other plants (adapted to compact soil) (1)		(2)

Q6.

Question Number	Correct Answer						Additional guidance	Mark
(a)	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	9	-6	36		
	35	2	16.9	8	-6	36		
	40	1	17.2	7	-6	36		
	$\Sigma D^2 =$					216		
	- differences in ranks of distance and diameter (1) - D² values correct (1)							(2)

Question Number	Correct Answer	Additional guidance	Mark
(b)(i)	• $6 \sum D^2 = 1296$ (1) • $n(n^2-1) = 720$ (1) • Correct r_s value = $-0.8(00)$ (1)	e.c.f. from (a) Correct answer (with minus sign) gains full marks Must be minus sign for marking point 3	(3)

Question Number	Correct Answer	Additional guidance	Mark
(b)(ii)	An answer that makes reference to the following: • there is a <u>significant negative</u> correlation between diameter of a limpet and height up the rocky shore (1) • because calculated value is greater than critical value (1) • at 5% significance level / 0.683 quoted (1)	Accept 2% or 1% critical value for m.ps 1 and 2 only Where no value is calculated in (b)(i) then accept marks in b(ii) for MP2 and 3 for theoretical explanation E.g. 'if value of r_s was greater than critical value (0.683) then there would be a significant correlation' would gain 2 marks	(3)

Question Number	Correct Answer	Additional guidance	Mark
(c)	An answer that makes reference to five of the following: • limpets kept in sea-water in tanks at the same {temperature / salinity} as they affect growth (1) • suitable number of {limpets in each tank / tanks containing limpets} to ensure reliability (1) • size of limpets in each tank selected to be within (narrow) range to start / or same distribution of sizes to ensure same potential for growth (1) • provision of food for limpets in equal amounts in each tank as food affects growth (1) • withdrawal of water from tanks for different periods of time (1) • size measured {mass / diameter / area of foot} because dependent variable must be quantitative to allow for statistical testing (1)		(5)

Q7.

Question Number	Correct Answer	Additional guidance	Mark
	An explanation that makes reference to the following: • sea plantain (1) • idea of different latitudes have different (mean) temperatures (1) • sea plantain grows {better / eq} at all (three) temperatures / bog sedge does not grow very well at {lower temperatures / 10 °C and 14 °C} (1) • credit appropriate comparative manipulated figures (1)		(4)

Q8.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to five of the following: Inaccurate because • {births / deaths} may occur (1) • migration may occur (1) • marking may affect survival (1) • mice may lose bands (1) • food encourages capture / trap discourages capture (1) Accurate because • {time / a week} is long enough for random dispersal (1) • a lot of traps were set / sample size large (1) • traps were randomly placed (avoids bias) (1)	Accept that some animals are more or less likely than others to enter trap	(5)

Q9.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: • because food attracts mouse into trap (1) • because {small entrance / size of trap} allows {small animals / mice} to enter trap / larger animals cannot enter trap (1) • because door slides down when the mouse {approaches the food / walks on board} (1)	Accept the entrance is big enough for mice to enter the trap	(3)

Q10.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to three of the following: • <i>Salicornia</i> has {higher salt concentration / lower water potential} than the mud (1) • because salt taken up by active transport (1) • therefore water is taken up by osmosis (1)		(3)

Q11.

Question Number	Answer	Mark
	An explanation that makes reference to three of the following: • less {evaporation / transpiration / diffusion} (1) • because {leaf is curled / small gap / hairs / sunken stomata / stomata in pits / waxy cuticle} (1) • trap water vapour / reduce {diffusion / concentration / water potential} gradient (1)	(3)

Q12.

Question Number	Answer	Additional Guidance	Mark
(i)	An answer that makes reference to the following: - axis for chlorophyll content is linear and uses at least half grid (1) - accurate plot and standard deviation for little traffic (1)		(2)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to three of the following: - quadrats placed at random / sampling at random (1) - method of random number sampling (1) - sampling done at same distance from {traffic / road} / transect placed parallel to {traffic / road} (1) - therefore removes bias / obtain running mean / ensures valid data (1)	e.g use of random number generator	(3)

Question Number	Answer	Additional Guidance	Mark
(iii)	An answer that makes reference to two of the following: {heavy traffic / more lead} reduces chlorophyll content (1) One from: - photosynthesis not measured (1) - lead may be from other sources / other named factor may be responsible (1) - only one species of plant investigated (1)	ACCEPT converse e.g. light / Mg / other pollutant	(2)

Q13.

Question Number	Answer	Additional Guidance	Mark
(a)	C ; nucleus and large (80S) ribosomes		(1)

Question Number	Answer	Additional Guidance	Mark
(b)	A ; algae have chloroplasts, the fungi do not		(1)

Question Number	Answer	Additional Guidance	Mark
(c)	1. (advantage of sexual reproduction / meiosis) {genetically different / greater gene pool / greater genetic diversity /eq} ; 2. (advantage of asexual reproduction / mitosis) faster / one of each organism needed / conserves advantageous alleles ;	2. Accept don't need a mate	(2)

Question Number	Answer	Additional Guidance	Mark
(d)(i)	C ; area exposed to bright sunlight and protected from the wind		(1)

Question Number	Answer	Additional Guidance	Mark
(d)(ii)	1. idea of using a quadrat ; 2. idea of {random / systematic} sampling (of wall) ; 3. {count number of squares/ determine area} containing lichen /eq ; 4. credit an indication of how the percentage was calculated ;	1. Accept description of quadrat, use of photo and a grid 3. NB reference to measuring percentage cover only is too vague as it is repeating stem of question	(3)

Question Number	Answer	Additional Guidance	Mark
(d)(iii)	1. ref to use of light {probe / sensor /eq} ; 2. idea of taking several measurements ;	1 Accept description of a light sensor 2. Accept ref to places or times of day	(2)

Question Number	Answer	Additional Guidance	Mark
(d)(iv)	1. plot a (scatter) graph of light intensity against lichen / eq ; 2. reference to looking for a correlation ; 3. reference to use of statistics test ; 4. appropriate named test eg Spearman's rank, Pearson ;	2. Accept ref to line of best fit, ref to correlation coefficient also gets Mp 3	(3)

Q14.

Question Number	Answer	Additional Guidance	Mark
	50 (1)		(1)

Q15.

Question Number	Acceptable Answers	Additional Guidance	Mark
	An answer that makes reference to six of the following: • relevant abiotic factor named (1) • select {sample sites with environmental differences /one site with environmental gradient} (1) • {quadrats / point frame} used {at random /in a transect} (1) • to measure presence or absence of lichens (1) • method used to measure abiotic factor described (1) • t test carried out to measure significant difference (1) • other named variable controlled or measured (1)	eg light intensity, temperature, distance from sea, altitude Allow calculation of percentage cover described Allow correlation test carried out to measure correlation if appropriate Allow standard deviations compared.	(6)