

PEARSON EDEXCEL A-LEVEL BIOLOGY B • 9B10

BIOLOGY



EXAM QUESTION PACK

TOPIC 10: ECOSYSTEMS

THE NATURE OF ECOSYSTEMS

SCORE

/36

PERCENTAGE

%

STEMUP

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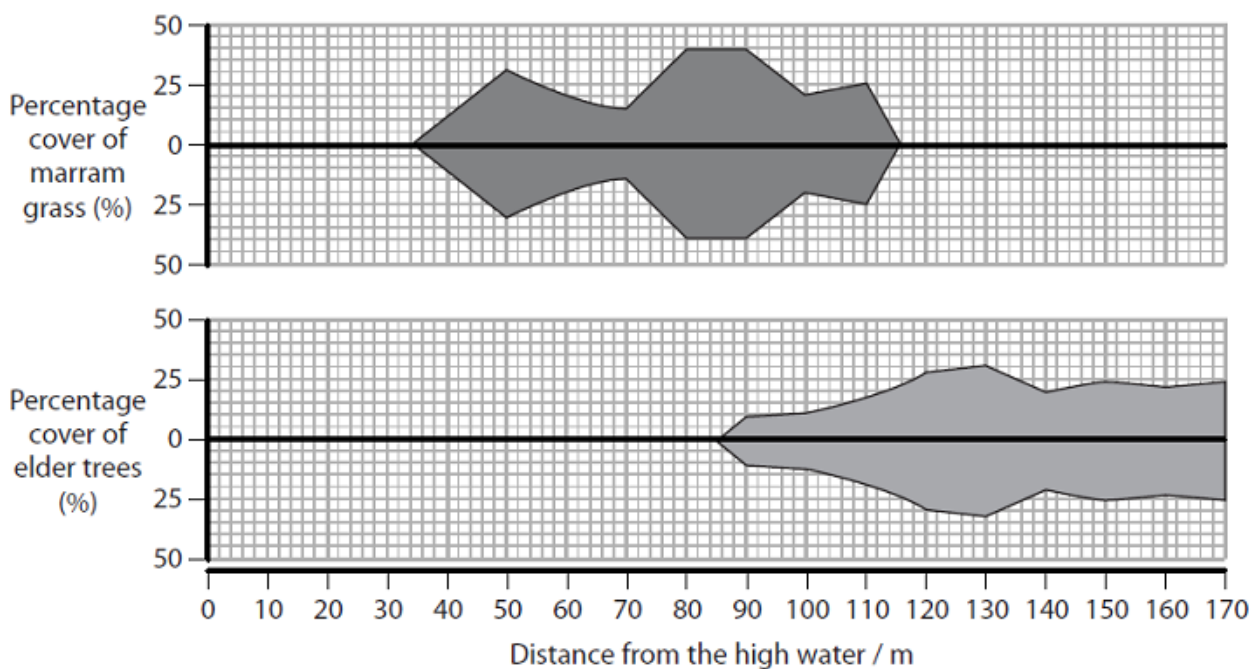
Q1.

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 represented the distribution of the two plant species in a kite diagram as shown.

The height of each kite diagram represents the percentage cover of plant species at different distances from the high water line.



(i) Compare and contrast the distribution of marram grass and elder trees.

(2)

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(ii) Explain how the student could have collected the data shown in the diagram.

(3)

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(Total for question = 5 marks)

Q2.

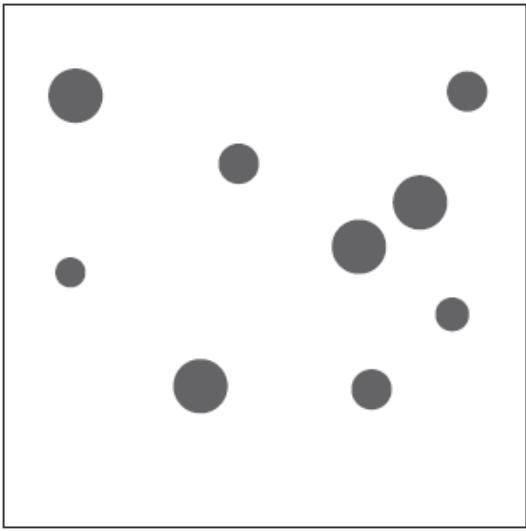
The drawing shows a plant called white clover, *Trifolium repens*.



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.

(3)

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(Total for question = 5 marks)

Q3.

Chester Zoo has 12 000 animals from 400 different species.

Chester Zoo aims "to be a major force in conserving biodiversity worldwide".

Chester Zoo supports an *in-situ* rhinoceros conservation and monitoring project in Chyulu Hills National Park in Kenya.

It is difficult to find and count the black rhinoceros because they roam freely across a large area.

However, the DNA of a black rhinoceros can be obtained from its dung (faeces).

(i) Devise a method by which black rhinoceros dung could be used to estimate the number of black rhinoceros living in Chyulu Hills National Park.

(5)

[illegible]

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(ii) DNA from dung indicated that 14 black rhinoceros were present in the park.

Explain why 14 black rhinoceros could be an underestimate of the population.

(2)

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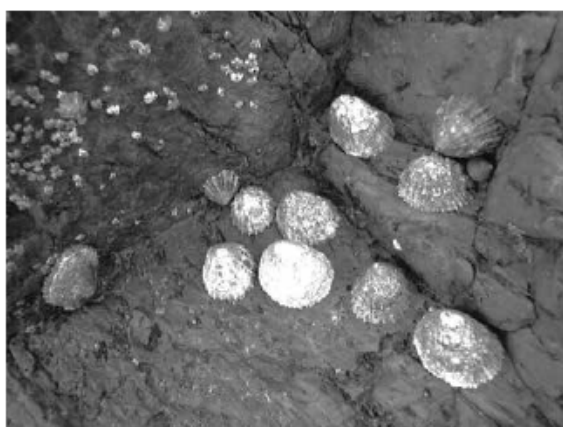
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Q4.

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.

(3)

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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.

(5)

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(Total for question = 13 marks)

Q5.

The island of Surtsey was formed by a volcanic eruption in the Atlantic Ocean in 1965.

The photographs show the formation of Surtsey in 1965 and part of the island in 2018.



volcanocafe.files.wordpress.com



vulkaner.no

Scientists have been studying the development of ecosystems on this island since its formation.

(i) State what is meant by the term ecosystem.

(1)

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(ii) Explain how ecosystems have developed on Surtsey since 1965.

(5)

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(Total for question = 6 marks)

Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
(i)	An answer that makes reference to two of the following: One from similarities: - neither found 34 to 35 m from high water line (1) - both found between 85 to 86 m and 116 m (1) One from differences: - marram grass found closer to high water line / elder is not found close to high water line / marram grass not found further inland / elder is found further inland (1) - range for marram grass is less than for elder / range for elder is greater than for marram grass / marram range is 80/81 m and elder range is 85 m (1) - maximum percentage cover of marram is greater than elder / marram maximum is 40% and elder maximum is 30% (1)	DO NOT ACCEPT description of data	(2)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: - use of {transect / tape measure / line} (1) - place {quadrats} at stated intervals (1) - method of how percentage cover measured (1)	Eg: number of squares occupied / point frame	(3)

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	Acceptable Answer	Additional Guidance	Mark
(i)	An experimental method that makes reference to five of the following steps: • use of experts to identify and collect many samples of rhinoceros dung from all areas of the park (1) • DNA extracted from rhinoceros cells and amplified using PCR (1) • use of { restriction endonucleases / appropriate primers } to obtain short tandem repeat sequences from DNA (1) • use of gel electrophoresis to separate DNA fragments (1) • description of method used to visualise fragments (1) • each different pattern of bands represents one individual rhinoceros (1)	e.g. radioactive probe / fluorescent probe / Southern blotting / UV light / autoradiography / X- rays	

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: • no dung found from some rhinoceros, so they were not counted (1) • closely related individuals have similar DNA profiles, so they may not be distinguished as separate individuals (1)		(2)

Q4.

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		(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			
	ΣD ² =						216		
	- differences in ranks of distance and diameter (1) - D² values correct (1)								

Question Number	Correct Answer	Additional guidance	Mark
(b)(i)	6 $\Sigma D^2 = 1296$ (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)

Q5.

Question Number	Answer	Additional Guidance	Mark
(i)	An answer that makes reference to the following: (interactions) of {organisms / biotic factors / communities / living} and {environment / abiotic factors / non-living factors} (1)	IGNORE habitat / area	1

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to five of the following: - colonisation (of bare rock) by pioneer species / extremophiles / by organisms that withstand {low water / dry / low soil} (1) (primary) succession occurs (1) - soil / humus produced (1) - therefore provides {water / minerals / nutrients / anchorage} for plants to grow (1) - provides niches / food / habitats for animals (1) - herbaceous plants / shrubs / trees become established / climax community emerging (1)	ACCEPT founder	5

