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Centre Number

2

Other Names

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GCE A LEVEL – NEW



1400U50-1E

S17-1400U50-1E

BIOLOGY – A2 unit 5 Practical Analysis Task

THURSDAY, 6 APRIL 2017 - MORNING

1 hour

For Examiner's use only				
Question	Maximum Mark	Mark Awarded		
1.	20			
2.	10			
Total	30			

ADDITIONAL MATERIALS

In addition to this examination paper, you will need a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page. Answer all questions in the spaces provided.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question. The maximum mark for this paper is 30.

Answer all questions.

1. On sheltered shores, such as Porthaethwy (Menai Bridge), there is a dense growth of algae, which provides a refuge for a rich animal community including barnacles, mussels, limpets, crabs and various marine snails. On exposed shores, such as Porth Trecastell (Cable Bay), Anglesey, there are fewer species of animals, but they are found in high densities because large numbers can be supported. Primary consumers on sheltered shores depend mainly on the algae growing on the rocks, while on exposed shores they are more likely to filter algae from the seawater.

Dogwhelks are carnivorous snails that live on rocks on the seashore. They feed on barnacles and mussels but only when covered by water. There is a genus of dogwhelk, *Nucella*, of which *N. lapillus* is common on the Welsh coast. They deposit their eggs in crevices in the rocks and individuals never move far from where they emerge from their eggs. The shape of their shells is variable and can confer certain advantages, especially with respect to wave action and protection against predators.

The image below shows *N. lapillus* depositing eggs on barnacles in a rock crevice.



An investigation was carried out to determine the effect of exposure on *N. lapillus* shells. Fifteen *N. lapillus* shells were collected from each site. The heights of the shells were measured to the nearest millimetre as indicated in the diagram, below.



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(a)

(i) 	Identify the main hazard faced when carrying out this investigation and suggest how you would minimize the risks associated with this hazard. [1]	Examiner only
(ii)	Suggest two precautions that should be taken to reduce the risk of harm to individual dogwhelks or their habitat. [1]	
 (iii)	State one way of improving the accuracy of the data collected. [1]	
(iv)	State two ways of improving the strength of evidence in this investigation. [2]	1400U501E

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- *(b)* Student's t-test was used to identify if there was a significant difference between the heights of *N. lapillus* shells collected from Porthaethwy and Porth Trecastell.
 - (i) Construct the null hypothesis used in the t-test when the data for the sites were compared. [1]

The tables below show the data collected for Porthaethwy (x_1) and Porth Trecastell (x_2) .

Height of N. lap	<i>oillus</i> shell / mm				
Porthaethwy	Porth Trecastell	Porth	aethwy	Porth T	recastell
x ₁	x ₂	$(x_1 - \overline{x}_1)$	$(x_1 - \bar{x}_1)^2$	$(x_2 - \overline{x}_2)$	$(x_2 - \bar{x}_2)^2$
33	22	0.3	0.1	-1.5	2.3
35	23	2.3	5.3	-0.5	0.3
34	23	1.3	1.7	-0.5	0.3
32	24	-0.7	0.5	0.5	0.3
34	23	1.3	1.7	-0.5	0.3
37	24	4.3	18.5	0.5	0.3
29	25	-3.7	13.7	1.5	2.3
30	22	-2.7	7.3	-1.5	2.3
30	23	-2.7	7.3	-0.5	0.3
37	24	4.3	18.5	0.5	0.3
31	24	-1.7	2.9	0.5	0.3
36	24	3.3	10.9	0.5	0.3
32	23	-0.7	0.6	-0.5	0.3
29	25	-3.7	13.7	1.5	2.3
32	23	-0.7	0.5	-0.5	0.3
$\bar{x}_1 = 32.7$	<i>x</i> ₂ =		$s_{1}^{2} = \frac{\sum (x_{1} - \overline{x}_{1})^{2}}{n_{1} - 1}$ = 7.37		$s_2^2 = \frac{\sum (x_2 - \overline{x}_2)^2}{n_2}$ =

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Examiner

only

Complete the table by calculating the mean (\bar{x}_2) and standard deviation (s_2^2) for the data from Porth Trecastell.

For the heights of the *N. lapillus* shells collected at Porthaethwy:

 n_1 = number; \bar{x}_1 = mean; s_1^2 = standard deviation²

(ii)

For the heights of the *N. lapillus* shells collected at Porth Trecastell:

$$n_2 =$$
 number; $\bar{x}_2 =$ mean; $s_2^2 =$ standard deviation² [2]

(iii) Calculate the value of *t* for these two samples using the formula:

$$t = \frac{\left(\overline{x}_1 - \overline{x}_2\right)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Give your answer to two decimal places.

t =

For this statistical test, the total number of degrees of freedom is calculated as:

degrees of freedom = $(n_1 - 1) + (n_2 - 1)$

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[2]

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(iv)

Calculate the degrees of freedom for this investigation and use this value to identify the critical value for *t* at a 5% probability level, from the table below. [2]

egrees of			level of p	robability		
freedom	0.100	0.050	0.025	0.010	0.005	0.001
22	1.32	1.72	2.07	2.51	2.82	3.51
24	1.32	1.71	2.06	2.49	2.80	3.47
26	1.32	1.71	2.06	2.48	2.78	3.44
28	1.31	1.70	2.05	2.47	2.76	3.41
30	1.31	1.70	2.04	2.46	2.75	3.39
(v 	degrees of) Use your c conclusion	freedom = alculated value for this investig	e of <i>t</i> and the gation.	critical value a	al value = t a 5% probab	bility to reach
(c) Su Po	uggest an expl prthaethwy and	anation for the Porth Trecast	e difference ir	n the mean va	alues of the s	
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)	(i)	Label tissues A, B, C and D on the plan.	Examine only 2]
	(ii) 	State why individual xylem vessels are not shown on the plan. [1]
	(iii)	The distance between points E and F on the photomicrograph was measured usin an eyepiece graticule as 120 eyepiece units (epu). Each epu was 0.01 mm. Use the lines E-F and G-H on the plan to calculate the actual diameter of G-H. Giv your answer in μ m.	 ig ig 3]
	(iv)	actual diameter of G-H = μ r Describe how the arrangement of vascular tissues in a stem would differ from tha shown in the root.	n at 1]

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(b) The electronmicrograph below shows a palisade mesophyll cell from a leaf.

END OF PAPER

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