Surname	Centre Number	Candidate Number
Other Names		2

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**	

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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.

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Answer **all** *questions.*

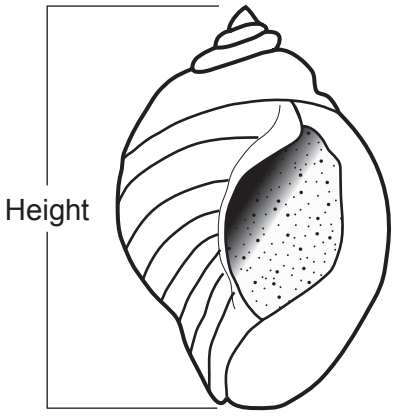
1. On sheltered shores, such as Porthaethwy (Menai Bridge), there is a dense growth of algae, which provides a refuge for a rich animal community including barnacles, mussels, limpets, crabs and various marine snails. On exposed shores, such as Porth Trecastell (Cable Bay), Anglesey, there are fewer 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]

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(ii) Suggest **two** precautions that should be taken to reduce the risk of harm to individual dogwhelks or their habitat. [1]

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(iii) State **one** way of improving the **accuracy** of the data collected. [1]

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(iv) State **two** ways of improving the strength of evidence in this investigation. [2]

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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]

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

Height of *N. lapillus* shell / mm	
Porthaethwy	Porth Trecastell
x_1	x_2
33	22
35	23
34	23
32	24
34	23
37	24
29	25
30	22
30	23
37	24
31	24
36	24
32	23
29	25
32	23
$\bar{x}_1$ = 32.7	$\bar{x}_2$ = ...

Porthaethwy	
$(x_1 - \bar{x}_1)$	$(x_1 - \bar{x}_1)^2$
0.3	0.1
2.3	5.3
1.3	1.7
–0.7	0.5
1.3	1.7
4.3	18.5
–3.7	13.7
–2.7	7.3
–2.7	7.3
4.3	18.5
–1.7	2.9
3.3	10.9
–0.7	0.6
–3.7	13.7
–0.7	0.5
	$s_1^2 = \frac{\sum (x_1 - \bar{x}_1)^2}{n_1 - 1}$ = 7.37

Porth Trecastell	
$(x_2 - \bar{x}_2)$	$(x_2 - \bar{x}_2)^2$
–1.5	2.3
–0.5	0.3
–0.5	0.3
0.5	0.3
–0.5	0.3
0.5	0.3
1.5	2.3
–1.5	2.3
–0.5	0.3
0.5	0.3
0.5	0.3
0.5	0.3
–0.5	0.3
1.5	2.3
–0.5	0.3
	$s_2^2 = \frac{\sum (x_2 - \bar{x}_2)^2}{n_2}$ = ...

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(ii) **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 deviation^2

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

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

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

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

Give your answer to two decimal places. [2]

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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(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]

Degrees of freedom	level of probability					
	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

degrees of freedom = ... critical value = ...

(v) Use your calculated value of *t* and the critical value at a 5% probability to reach a conclusion for this investigation. [3]

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(c) Suggest an explanation for the difference in the mean values of the shell heights at Porthaethwy and Porth Trecastell. [5]

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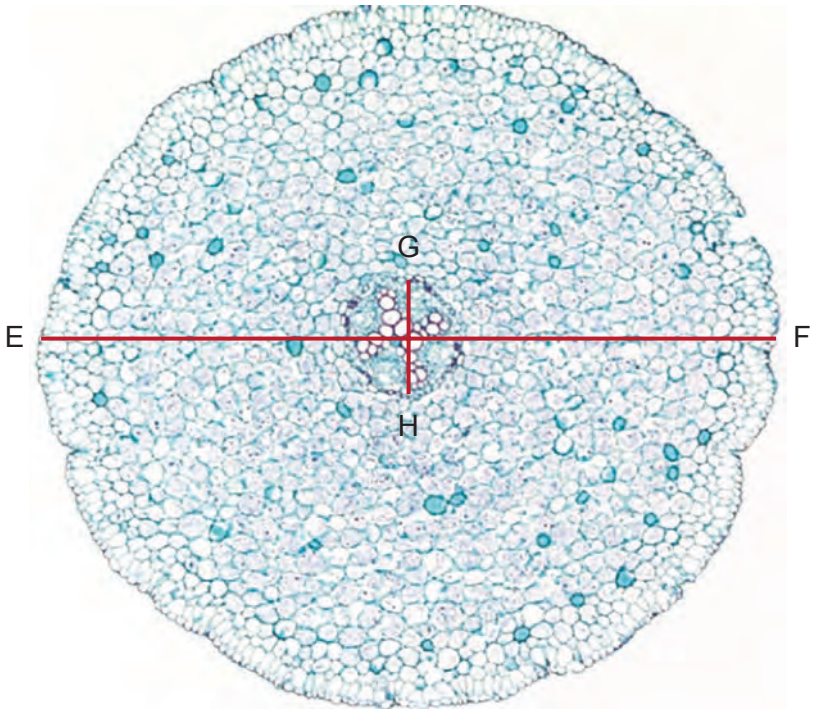
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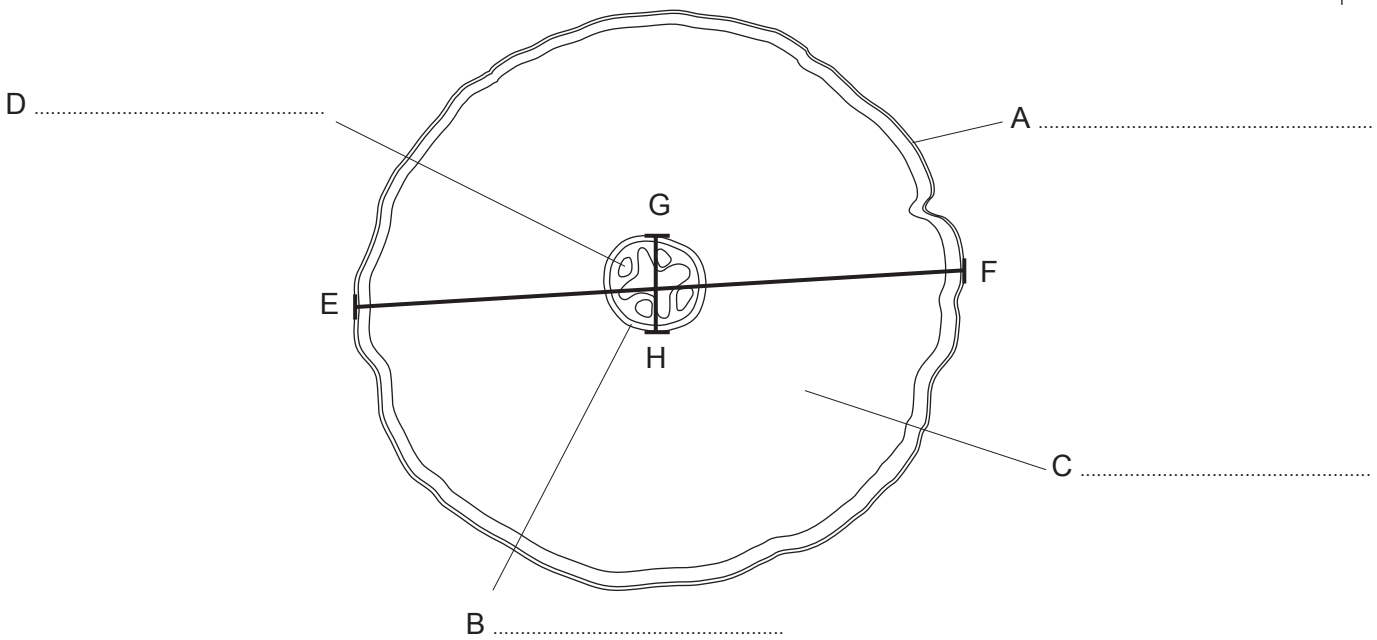
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2. A photomicrograph of a transverse section of a root and a low power plan to show the distribution of the tissues in the root are shown below.





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(a) (i) **Label** tissues A, B, C and D on the plan. [2]

(ii) State why individual xylem vessels are not shown on the plan. [1]

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(iii) The distance between points E and F on the photomicrograph was measured using 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. Give your answer in μm. [3]

actual diameter of G-H = ... μm

(iv) Describe how the arrangement of vascular tissues in a stem would differ from that shown in the root. [1]

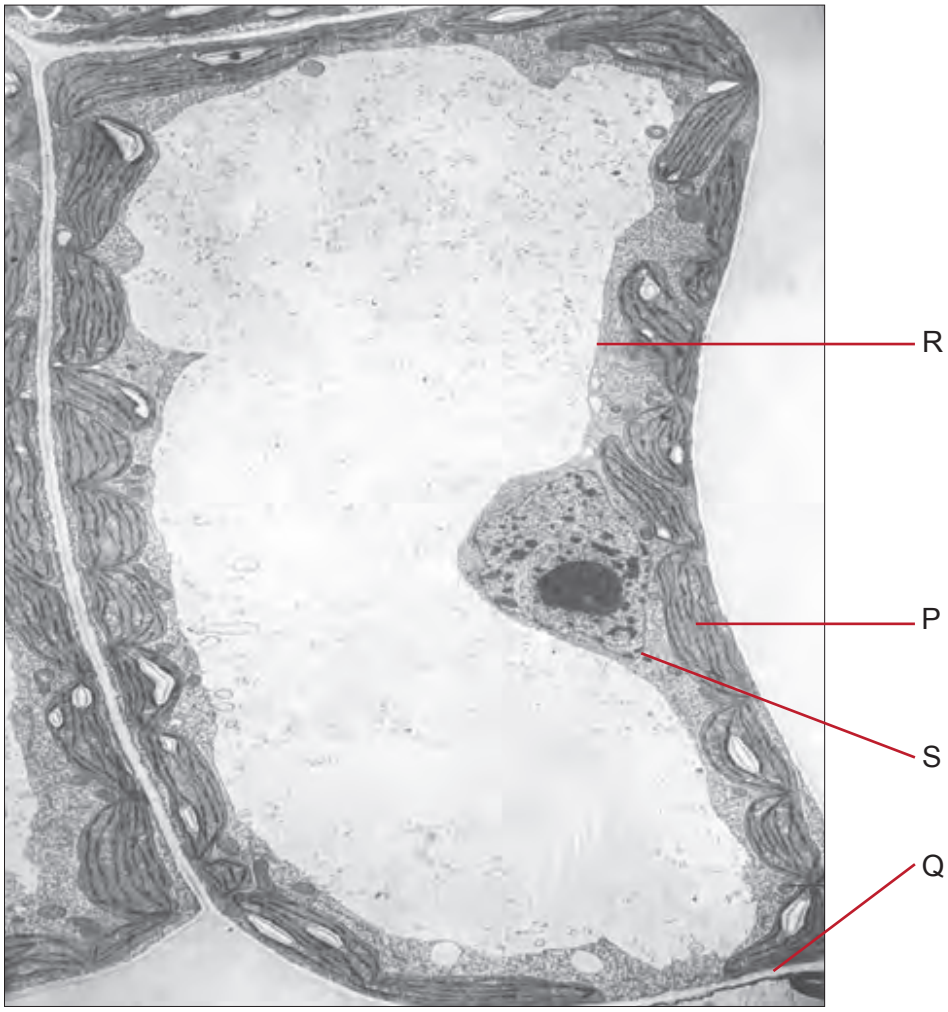
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(b) The electronmicrograph below shows a palisade mesophyll cell from a leaf.



(i) Identify structures P, Q, R and S. [2]

P .....

Q .....

R .....

S .....

(ii) The cell wall of this type of cell is much thinner than the cell walls of other cells in the leaf. Suggest why this thinner cell wall provides a selective advantage. [1]

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