

Please check the examination details below before entering your candidate information

Candidate surname

Other names

**Pearson Edexcel
International
Advanced Level**

Centre Number

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Candidate Number

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Friday 10 May 2019

Morning (Time: 1 hour 30 minutes)

Paper Reference **WBI06/01**

Biology

Advanced

Unit 6: Practical Biology and Investigative Skills

You must have:

Calculator, HB pencil, ruler

Total Marks

--

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 50.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, including your use of grammar, punctuation and spelling.
- Candidates may use a calculator.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Answer ALL questions.

- 1 The photograph below shows a field trial of several varieties of durum wheat (*Triticum durum*) growing in West Africa.



This field trial identified three varieties of durum wheat that tolerate temperatures above 37°C. These varieties also gave a good yield of grain after only 100 days from planting.

Observing mitosis can be an indicator of the rate of growth of a plant. This can be recorded by calculating the mitotic index.

The mitotic index (MI) can be calculated using the formula

$$\text{MI} = \frac{\text{number of cells in mitosis}}{\text{total number of cells}} \times 100$$

A sample of tissue from one variety of durum wheat was analysed with the following results.

Number of cells in mitosis = 41

Number of cells not in mitosis = 121

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(ii) State **two** abiotic factors, other than temperature, that could affect the yield of grain. (1)

(iii) Choose **one** of the factors you have identified in (ii). Explain how this factor could be controlled. Describe what effect it could have on the results if it is not controlled. (2)

Abiotic factor

How this factor could be controlled

Effect it could have on the results if it is not controlled.....

result is not valid. if ... too high, ---

T { water bath
air conditioner
incubator.

pH → buffer ; pH meter

water content: moisture meter

light intensity: light meter

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(c) Explain why some varieties of durum wheat can grow at high temperatures.

(3)

.....

.....

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.....

.....

.....

.....

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.....

.....

(Total for Question 1 = 12 marks)

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2 Lichens are living organisms that grow on rocks. Bacteria can be found in lichens. The photograph below shows lichens growing on rocks in the Antarctic.



lichens

© Maksym Deliyergiyev / Shutterstock

A scientist removed samples of lichen. In the laboratory, two types of bacteria, **A** and **B**, were extracted from these lichen samples.

The scientist carried out an investigation to test the effect of an antibiotic on these bacteria.

The bacteria were spread onto agar plates.

Discs containing the antibiotic lincomycin were then placed on the surface of the agar.

The plates were then incubated at 28°C for 24 hours.

The diameter of each inhibition zone was measured.

The results of this investigation are shown below.

Type **A** diameter of each inhibition zone (mm)

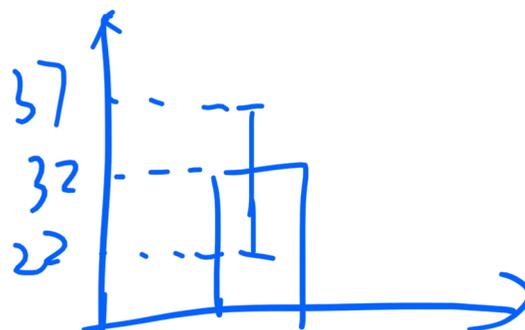
37 26 30 37 25 22 33 36 35 36 37 22 22 30 25

15
32 22-37

Type **B** diameter of each inhibition zone (mm)

21 25 32 32 18 17 28 31 29 30 31 17 16 25 20

15



(a) Write a suitable null hypothesis for this investigation.

(2)

There is not significant difference
between ... (2 vs 1)
There is no correlation between
... (1 vs 1)

(b) Calculate the mean diameter of the inhibition zones for each type of bacteria.

Prepare a suitable table to display the **raw data** and your calculated **mean** for each type of bacteria.

(3)

d of A (mm)	d of B (mm)
mean	

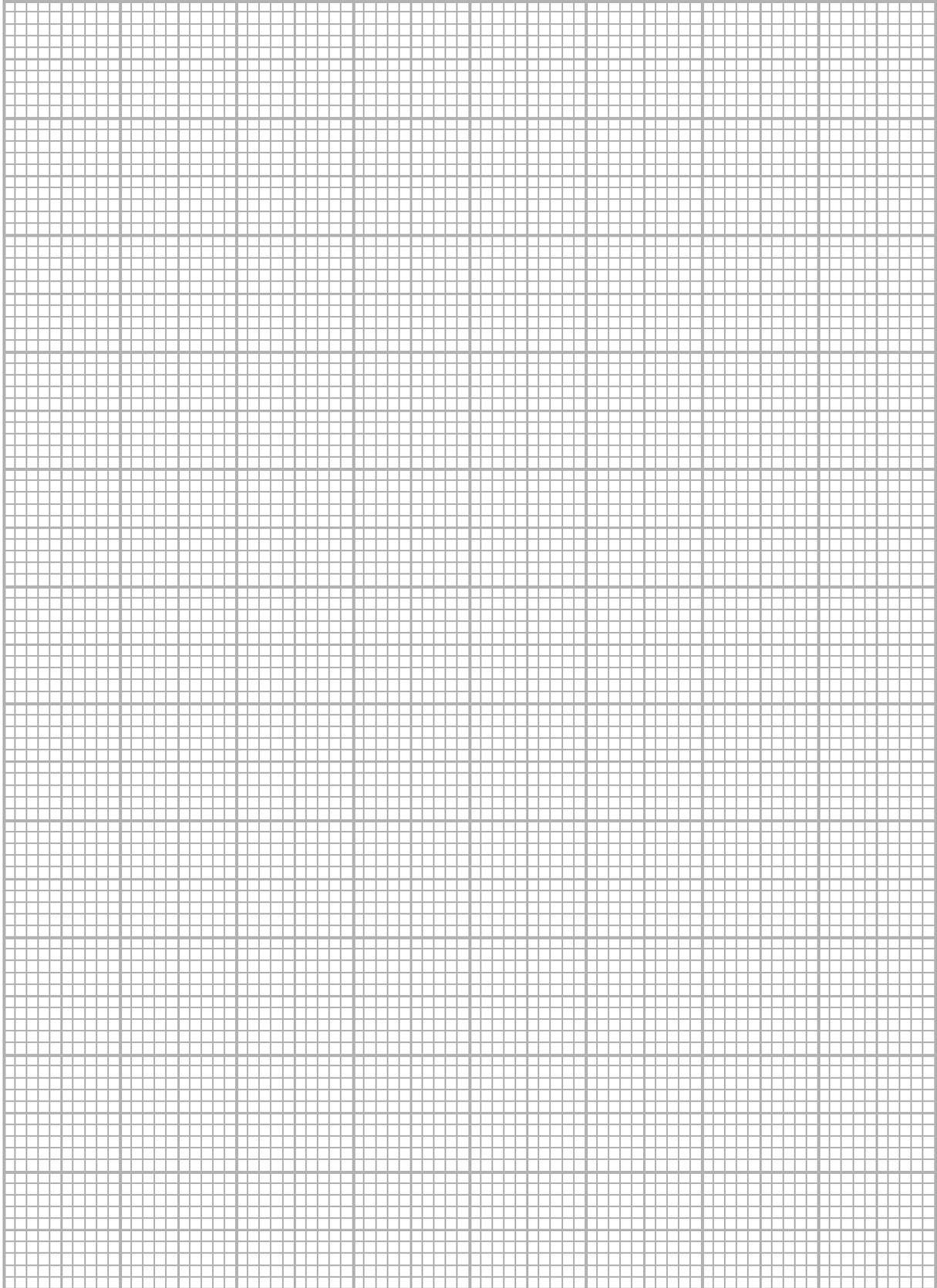
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(c) On the graph paper below, draw a suitable graph to show the mean diameter of the inhibition zone for each type of bacteria.

Include an indication of the variability of the data.

(3)



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(d) The scientist applied a t test to the data. A value of $t = 2.44$ was calculated.

The table below shows critical values of t for different degrees of freedom at different levels of significance.

The number of degrees of freedom is calculated using the formula

$$\text{degrees of freedom} = (n_1 - 1) + (n_2 - 1) = 28$$

where n_1 and n_2 represent the size of each sample.

degrees of freedom	$p = 0.05$	$p = 0.01$	$p = 0.005$
11	2.20	3.11	3.50
12	2.18	3.05	3.43
13	2.16	3.01	3.37
14	2.14	2.98	3.33
15	2.13	2.95	3.29
16	2.12	2.92	3.25
17	2.11	2.90	3.22
18	2.10	2.88	3.20
19	2.09	2.86	3.17
20	2.09	2.84	3.15
21	2.08	2.83	3.14
22	2.07	2.82	3.12
23	2.07	2.81	3.10
24	2.06	2.80	3.09
25	2.06	2.79	3.08
26	2.06	2.78	3.07
27	2.05	2.77	3.06
28	2.05	2.76	3.05
29	2.04	2.76	3.04
30	2.04	2.75	3.03

- ① Critical value ($p=0.05$) is 2.05
- ② 2.44 is greater than critical value
- ③ $P < 0.05 \Rightarrow$ reject null hypothesis
 $P > 0.05 \Rightarrow$ accept
- ④ (hypothesis)
- ⑤ Comment on range bar. (overlap)



P 5 6 1 5 2 A 0 1 0 2 0

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What conclusions can be drawn from this investigation?

Use your graph and the information in the table to explain your answer.

(4)

correlation coefficient : $|value| > critical$ reject
t-test : $value > critical$ reject
chi test : $value > critical$ reject



P 5 6 1 5 2 A 0 1 1 2 0

(e) Suggest why it may **not** be reasonable to draw valid conclusions from the results of this investigation.

(4)

① sample size too small

② ... - (2) is not control

③ data

(Total for Question 2 = 16 marks)

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3 Some people with illnesses secrete fewer digestive enzymes from the pancreas than healthy people.

One of the enzymes secreted by the pancreas is protease.

Protease is an enzyme that hydrolyses proteins to form amino acids.

The activity of protease can be investigated using a solution of the protein casein as a substrate. This solution changes from white to colourless as the protein is hydrolysed.

A student formed the following hypothesis:

The greater the concentration of protease the faster the rate of hydrolysis of casein.

Plan an investigation to provide evidence to support or reject this hypothesis.

Your answer should give details under the following headings.

(a) A consideration of whether there are any safety issues you would need to take into account.

(2)

① allergy

lab ← ② sharp glassware hurt
field ← ③ animal/plant is toxic

claym



(b) Suggestions for preliminary practical work that you might undertake to ensure your proposed method would provide meaningful data.

(3)

① find suitable range of (independ)

↓
independ

② find suitable (control variable)

③ practise the method
to see if it works



P 5 6 1 5 2 A 0 1 5 2 0

(c) A detailed method, including an explanation of how important variables are to be controlled or monitored.

(10)

[2 marks are available in this section for the quality of written communication.]

① depend variable is (measure).
Then (measure) can be used to
convert to ----

② 2 control variable & How to
control (equipment)

③ depend variable How to
measure (equipment)

④ Repeat & mean

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(d) A clear explanation of how your data are to be recorded, presented and analysed in order to draw conclusions from your investigation.

(4)

① 表

concentration (g/cm ³)			
t (s)			
mean			

② 图

rate
t



concentration

③ use correlation coefficient
(1 vs 1)

t-test (2 vs 1)

chi test (实 vs 期)



(e) The limitations of your proposed method.

(3)

① difficult to measure
(depend variable)

② difficult for (control variable)
↓
24 { abiotic
biotic

(Total for Question 3 = 22 marks)

TOTAL FOR PAPER = 50 MARKS



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