Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
International Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Friday 22 January 2021

Morning (Time: 1 hour 20 minutes) | Paper Reference **WBI16/01**

Biology

International Advanced Level
Unit 6: Practical Biology and Investigative Skills

You must have:
Scientific calculator, ruler, HB pencil

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.*
- **Show all your working in calculations and include units where appropriate.**

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.*

Advice

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

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Pearson

Answer ALL questions.

1 The photograph shows flowers of a water hyacinth plant, *Eichhornia crassipes*.

(Source: © Natalia Kuzmina / Alamy Stock Photo)

These plants are an invasive species found in lakes and rivers throughout Asia. They grow rapidly, producing many flowers and seeds.

A student observed that each flower has six anthers and one stigma.

Each anther was observed to release many pollen grains.

When pollen grains from the water hyacinth are placed in a sucrose solution they grow pollen tubes.

These could be seen growing within 30 minutes.

The student wanted to find out if an extract from the stigma stimulated the growth of pollen tubes.

(a) Describe an experiment to investigate the effect of this extract on the rate of pollen tube growth.

(6)

(b) The tip of the pollen tube is protected by an outer layer of pectin.

Pectin is a polysaccharide.

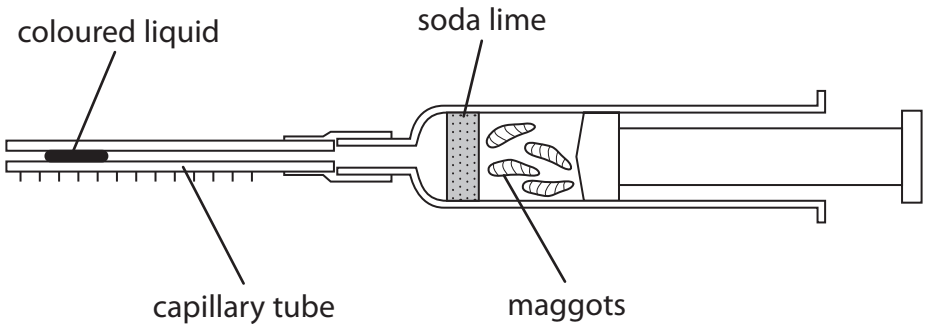
Starch grains, mitochondria and vesicles are present in the tip of the pollen tube.

Describe how these structures are used in the production of pectin at the tip of a pollen tube.

(4)

(Total for Question 1 = 10 marks)

2 The diagram shows some maggots in a respirometer.



This respirometer can be used to investigate the uptake of oxygen during the respiration of maggots.

A student used this respirometer with soda lime to measure the movement of the coloured liquid.

The table shows the results.

minute	1st	2nd	3rd	4th	5th
distance moved (l) by coloured liquid in one minute / mm	4	4	5	4	5

(a) (i) Calculate the **mean** rate of oxygen uptake in $mm^3\ min^{-1}$.

The internal diameter of the capillary tube was 0.2 mm.

The volume of a cylinder (V) is calculated using the formula

$$\pi r^2 l$$

Give your answer to **two** significant figures.

(3)

..... $mm^3\ min^{-1}$

(ii) The **mean** rate of carbon dioxide released by the maggots was 0.11 mm^3 min^{-1}.

Calculate the respiratory quotient (RQ) value for this investigation.

(2)

RQ .....

(iii) The soda lime was removed and replaced with glass beads in order to calculate the RQ.

Suggest why this allows the student to calculate the RQ.

(1)

.....

.....

.....

(b) (i) State **two biotic** variables that could affect this investigation.

(2)

First variable .....

Second variable .....

(ii) Choose **one** of the variables you have identified in (b)(i).

Describe how this variable could be controlled and the effect it could have on the results if it is not controlled.

(2)

Variable .....

Describe how this variable is controlled.

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.....

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Describe the effect it could have on the results if it is not controlled.

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(Total for Question 2 = 10 marks)

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3 People living in some villages in Ecuador, a South American country, keep chickens as a source of food.

These people have been encouraged to add ampicillin, an antibiotic, to the chicken food.

Feeding ampicillin to chickens may cause the bacterium, *E. coli*, to become resistant to ampicillin.

Village **A** was the first in the area to add ampicillin to the chicken food.

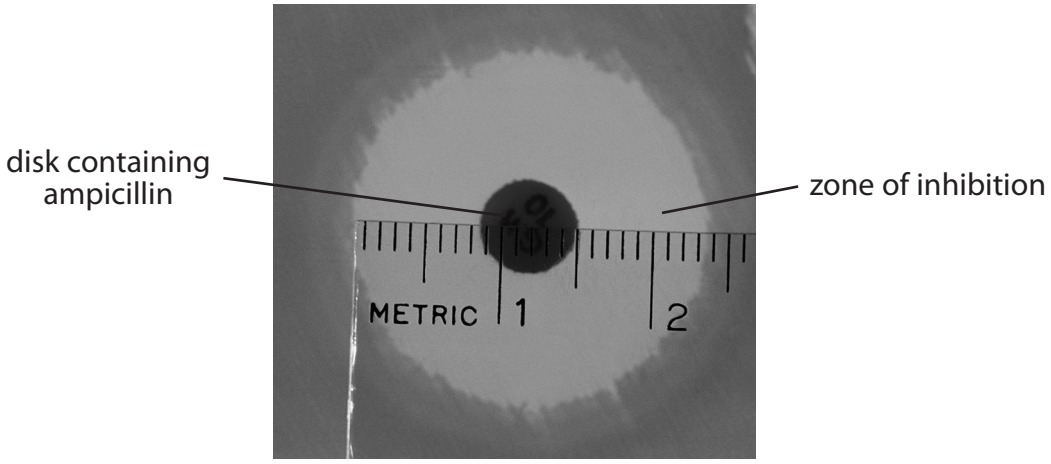
Village **B** has only recently added ampicillin to the chicken food.

Samples of *E. coli* were taken from the guts of chickens from each village.

Each sample was cultured on a nutrient agar plate.

A disc containing ampicillin was placed on each culture. After incubation, the diameter of the clear zone of inhibition was measured in millimetres.

The photograph shows the zone of inhibition on one nutrient agar plate after incubation for 72 hours.



(Source: © Gado Images / Alamy Stock Photo)

The results:

Village **A**

15.9 16.2 14.5 17.1 15.3 15.4 16.2 16.8 14.4 16.8

18.2 16.1 16.9 16.6 16.4

Village **B**

17.2 17.0 17.3 15.8 17.3 18.9 19.1 19.3 16.9 14.8

16.7 17.4 17.8 17.4 16.8

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

(1)

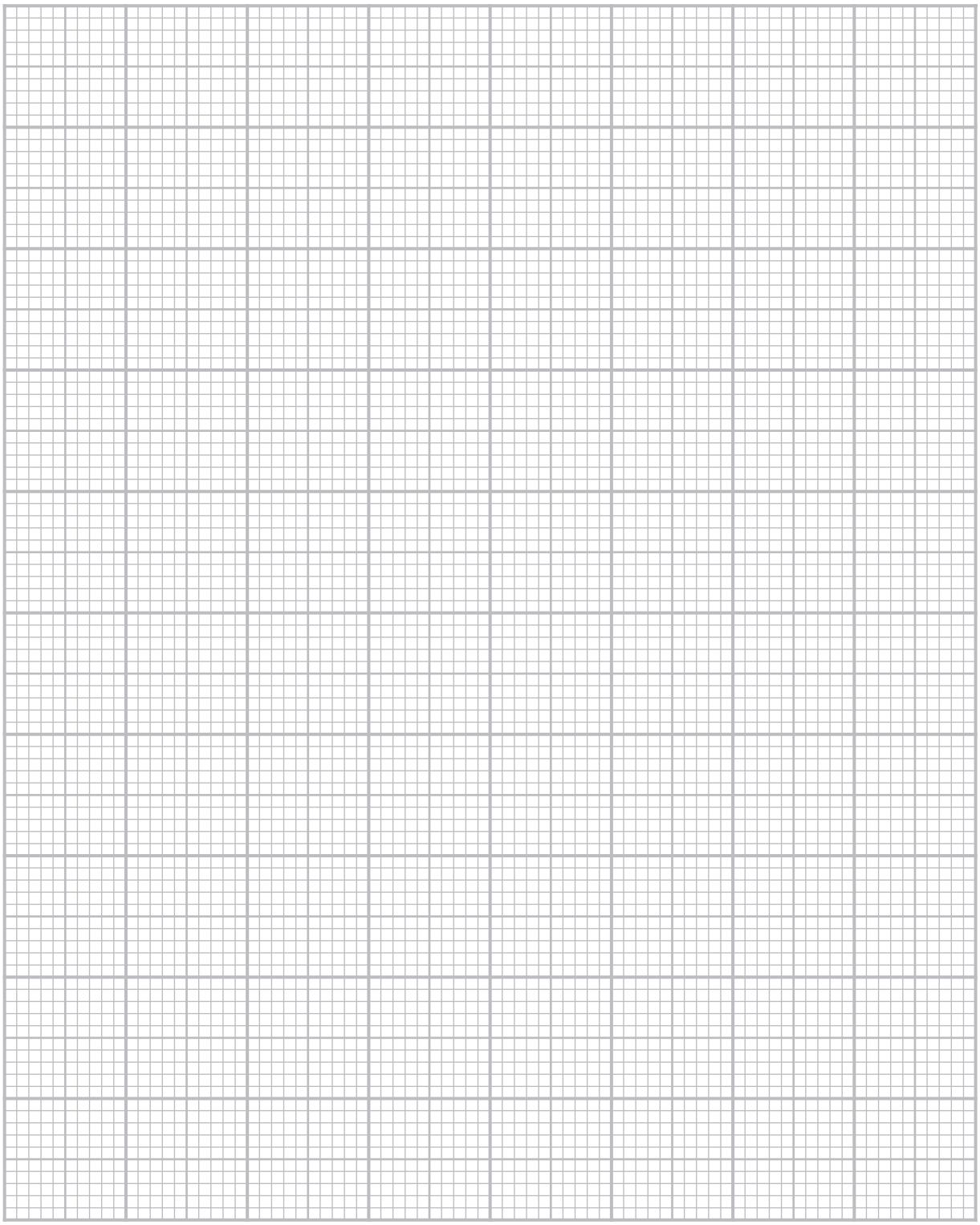
(b) (i) Draw a suitable table to display the results and your calculated **means** for village **A** and for village **B**.

(3)

(ii) Plot a graph to show the mean diameter of the zone of inhibition for village **A** and for village **B**.

Include an indication of the variability of the results.

(3)



(iii) A student analysed the data with a *t* test using the formula

$$t = \frac{\left(\bar{x}_A - \bar{x}_B\right)}{\sqrt{\frac{\left(S_A\right)^2}{n_A} + \frac{\left(S_B\right)^2}{n_B}}}$$

where:

$\bar{x}$ is the mean value for each village

n is the number of samples for each village

$(S_A)^2 = 0.99$ and $(S_B)^2 = 1.39$

Calculate the value of *t*.

(3)

Answer .....

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(iv) The table shows the critical values of *t* for different degrees of freedom.

The number of degrees of freedom = $(n_A - 1) + (n_B - 1)$

Degrees of freedom	p = 0.05	p = 0.01
15	2.13	2.95
16	2.12	2.92
17	2.11	2.90
18	2.10	2.88
19	2.09	2.86
20	2.09	2.84
21	2.08	2.83
22	2.07	2.82
23	2.07	2.81
24	2.06	2.80
25	2.06	2.79
26	2.06	2.78
27	2.05	2.77
28	2.05	2.76
29	2.04	2.76
30	2.04	2.75

A scientist suggested that there was evidence for the development of resistance to ampicillin in *E. coli* in Village **B**.

Criticise this suggestion.

Use the information given and the analysis of the results to support your answer.

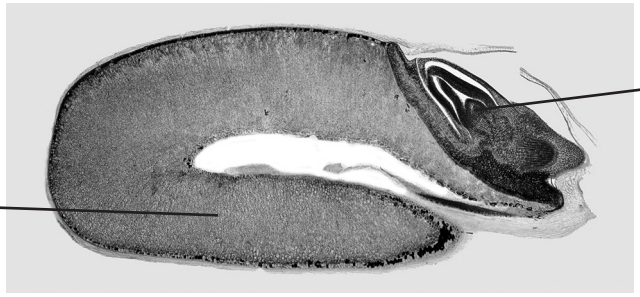
(2)

(c) Suggest **two** improvements that could be made to this investigation.

(2)

(Total for Question 3 = 14 marks)

4 The photograph shows a section through a wheat grain.



(Source: © DR KEITH WHEELER / SCIENCE PHOTO LIBRARY)

Wheat grains store starch in the endosperm.

During germination the embryo releases amylase from the cells surrounding the endosperm.

The starch is digested by the amylase. This allows the embryo to grow.

Abscisic acid inhibits the germination of wheat grains.

A student formed the following hypothesis:

the greater the concentration of abscisic acid (ABA), the smaller the production of amylase by the wheat grain.

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

(a) Describe preliminary practical work that you might undertake to ensure your proposed method would provide quantitative results.

(3)

(b) Devise a detailed method, including how you would control and monitor important variables.

(8)

(c) Describe how your results should be recorded, presented and analysed in order to draw conclusions from your investigation.

(3)

(d) Suggest **two** limitations of your proposed method.

(2)

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(Total for Question 4 = 16 marks)

TOTAL FOR PAPER = 50 MARKS

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