Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Friday 16 June 2023

Morning (Time: 1 hour 20 minutes)

Paper reference **WBI16/01**

Biology

International Advanced Level
UNIT 6: Practical Skills in Biology II

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 out** 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.

Turn over ▶

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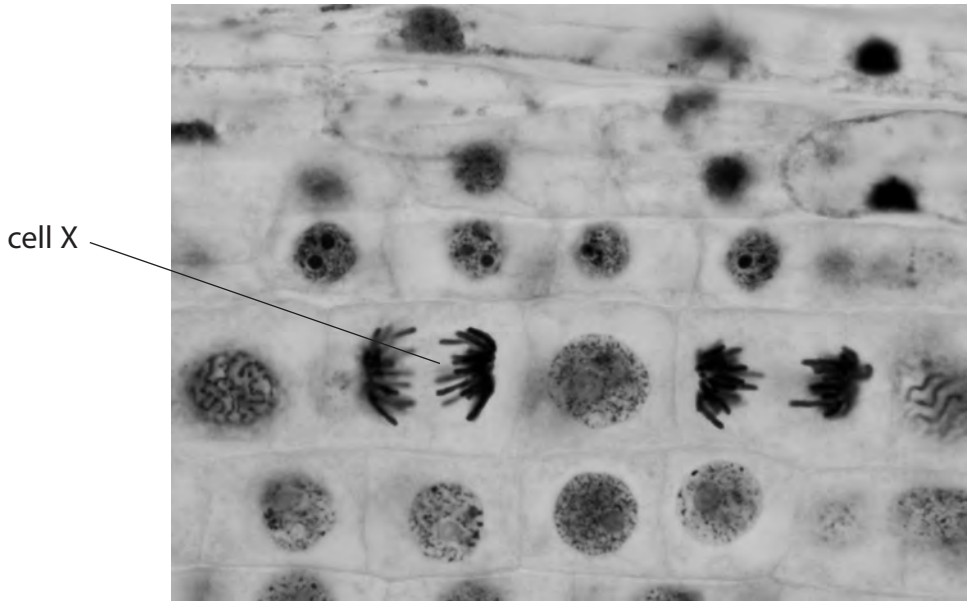
Pearson

Answer ALL questions.

1 The photograph shows cells undergoing mitosis in the root of an onion plant.



(Source: © blickwinkel/Alamy Stock Photo)

(a) Name the stage of mitosis shown in cell X.

(1)

.....

(b) A student read a scientific report that stated:

'Cell division was reduced when plant cells were treated with a caffeine solution.'

(i) Describe an experiment to measure the mitotic index of cells from onion roots treated with different concentrations of caffeine solution.

(6)

(ii) The scientific report suggested that caffeine affected the production of the cellulose molecules needed for cell division.

Describe the structure of a cellulose molecule.

(3)

(Total for Question 1 = 10 marks)

2 The photograph shows part of a desert in Mexico.

(Source: © Alexander Semkin/Alamy Stock Photo)

A scientist observed that one species of cactus, *Neobuxbaumia tetetzo*, was often found near a species of tree, *Mimosa luisana*.

The scientist decided to test the hypothesis that the cactus plants often grow close to mimosa trees.

One hundred locations were selected at random. A 10 × 10 m quadrat was placed at each location.

The presence or absence of each species was recorded in each quadrat.

(a) Suggest one possible benefit to cactus plants of growing near mimosa trees.

(1)

(b) Suggest **one** risk the scientist might encounter when carrying out this investigation and how you could reduce this risk.

(2)

Risk

.....

How to reduce the risk

.....

.....

(c) The table shows the results of this investigation.

Mimosa trees	Number of quadrats	
	Cactus plants present	Cactus plants absent
Present in quadrat	60	4
Absent in quadrat	16	20

(i) An odds ratio can be used to determine if the presence of mimosa trees has an effect on the presence of the cactus plants.

Calculate an odds ratio using the following steps.

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

$$\text{Step 1} = \frac{\text{Number of quadrats in which mimosa trees and cactus plants are present}}{\text{Number of quadrats in which mimosa trees are absent and cactus plants are present}}$$

$$\text{Step 2} = \frac{\text{Number of quadrats in which mimosa trees are present and cactus plants are absent}}{\text{Number of quadrats in which both mimosa trees and cactus plants are absent}}$$

Odds ratio = Step 1 ÷ Step 2

(3)

Odds ratio .....:1

(ii) The table shows how the odds ratio can be used in this investigation.

Odds ratio	Presence of mimosa trees
< 1	Reduces the likelihood of cactus plants being present
$= 1$	Has no effect on the likelihood of cactus plants
> 1	Increases the likelihood of cactus plants being present

Give a conclusion that can be made from the results of this investigation.

(1)

.....

.....

.....

(d) Abiotic variables in the soil cannot be controlled in this investigation.

However, these variables can be measured to confirm that these plants are growing in similar conditions.

(i) State **two** abiotic variables in the soil that could affect this investigation.

(2)

First variable

.....

Second variable

.....

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

State the effect it could have on the results if the measured values were not similar.

(1)

Variable

.....

The effect it could have on the results if the values were not similar.

.....

.....

(Total for Question 2 = 10 marks)

3 The photograph shows a fruit fly, *Drosophila suzukii*, on the skin of a fruit.

(Source: © dpa picture alliance/Alamy Stock Photo)

This species of fruit fly is endemic to southeast Asia but recently it has become an invasive species in Europe.

The female lays fertilised eggs under the skin of fruits.

The eggs hatch into larvae that feed on the fruit.

The larvae develop into pupae that become adult flies.

A student investigated the effect of using an organic pesticide, pyrethrum, on the hatching of eggs and the development of pupae.

Sixteen flasks containing a culture medium were prepared. Eight flasks had 0.5 g of pyrethrum added.

Each flask had one female fly that layed eggs for 24 hours. The fly was then removed and the eggs were allowed to hatch and develop into pupae.

The photograph shows fly pupae in one of the flasks.

(Source: © Sundry Photography/Alamy Stock Photo)

After five days, the number of pupae in each flask was counted.

The results were:

Number of pupae from untreated culture medium (A)

72 68 81 56 43 52 60 64

Number of pupae from treated culture medium (B)

45 56 39 40 29 38 35 46

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

(1)

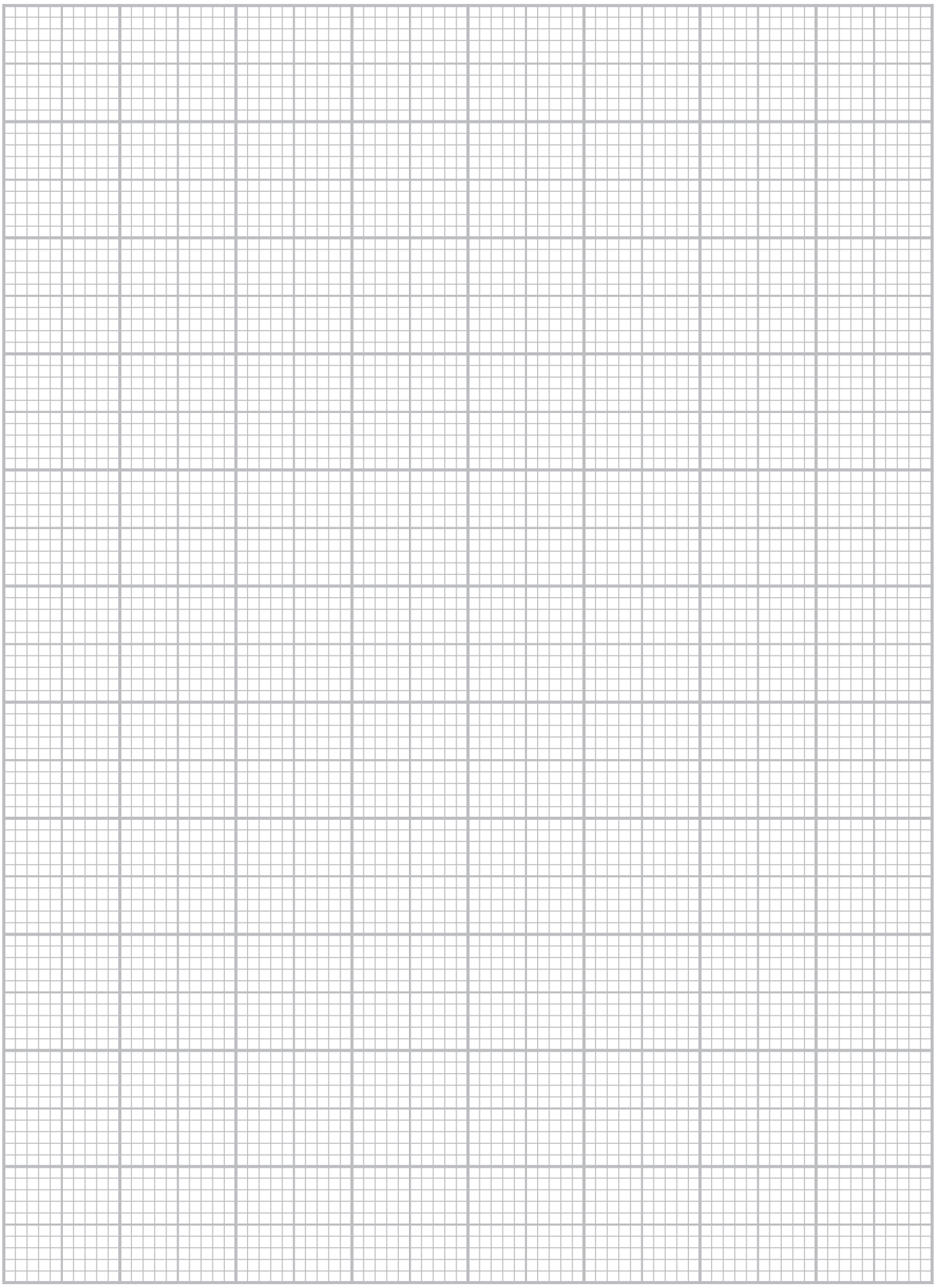
(b) Draw a suitable table to display these **data** and the calculated **means** for the number of pupae from the flasks containing the untreated and treated culture medium.

(2)

(c) Draw a suitable graph to show the mean number of pupae from the untreated culture medium and treated culture medium.

Include an indication of the variability of the data.

(3)



(d) The student analysed the data with a *t* test using the formula:

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

where:

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

n is the number of samples for each treatment

$(S_A)^2 = 143.1$ and $(S_B)^2 = 65.7$

(i) Calculate the value of *t*.

(2)

Answer .....

(ii) 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
10	2.23	3.17
11	2.20	3.11
12	2.18	3.05
13	2.16	3.01
14	2.14	2.98
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

Deduce the conclusions that can be drawn from this investigation.

Use the information in this table to support your answer.

(2)

(e) Describe **two** ways this investigation could be extended to collect more data to either support or reject the hypothesis.

(2)

(f) Pyrethrum is applied to fruit crops growing in fields.

Suggest **two** reasons why applying pyrethrum to fruit crops in fields might not reduce damage to fruits.

(2)

(Total for Question 3 = 14 marks)

4 The photograph shows some leaves of *Piper betle*, a plant that grows in the Philippines and other countries in southeast Asia.

(Source: © Bowonpat Sakaew/Alamy Stock Photo)

The leaves are eaten as a traditional cure for human digestive disorders.

The leaves are thought to prevent the growth of some species of bacteria.

A student formed the following hypothesis:

The leaves of Piper betle contain antibacterial compounds that reduce bacterial growth.

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

Your answer should give details under the following headings.

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

(2)

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

(9)

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

(3)

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

(2)

(Total for Question 4 = 16 marks)

TOTAL FOR PAPER = 50 MARKS

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