Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

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.*

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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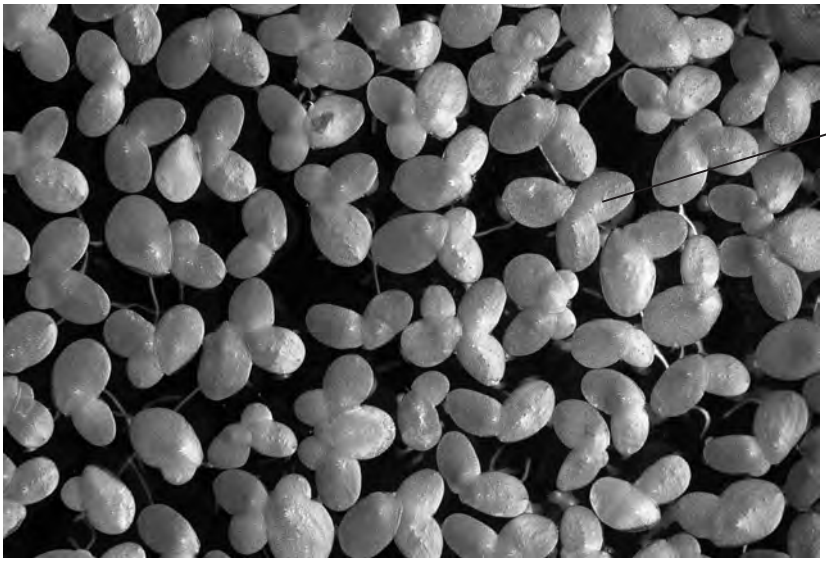
Pearson

Answer ALL questions.

1 The photograph shows *Lemna minor*, a species of aquatic plant.



(Source: © SINCLAIR STAMMERS/SCIENCE PHOTO LIBRARY)

Magnification $\times 1$

These plants live in ponds, lakes and slow-flowing rivers in Asia.

These plants absorb nitrate ions and grow rapidly.

Each plant develops three leaflets and then divides to produce a daughter plant.

In optimum conditions, the plants divide every two days.

(a) Describe an experiment to investigate the effect of nitrate ion concentration on the rate of growth of these plants.

(6)

(b) Explain the roles of nitrate ions in cell division to produce daughter plants.

(3)

(Total for Question 1 = 9 marks)

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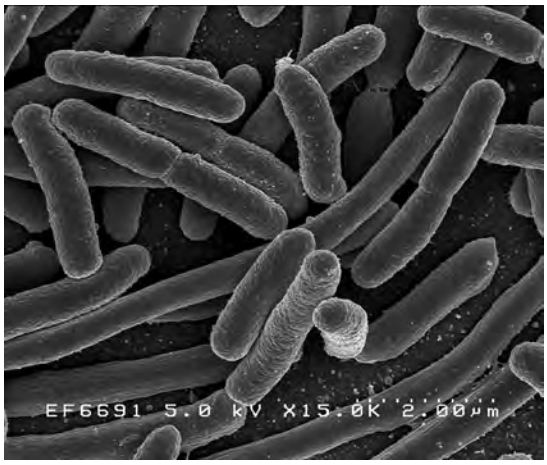
2 The photograph shows bacterial cells of *E.coli*, as seen using an electron microscope.



(Source: © BSIP SA/Alamy Stock Photo)

The growth of bacteria in a liquid culture can be investigated.

The number of bacterial cells in the culture can be measured using the dilution plating technique.

(a) Identify **one** risk that might be encountered when carrying out this technique and how this risk could be reduced.

(2)

Risk

.....

.....

How this risk could be reduced

.....

.....

.....

(b) The growth rate constant (k) for a bacterial population can be found using the equation:

$$k = \frac{\log_{10} N_t - \log_{10} N_0}{0.301 \times t}$$

N_t is final number of bacteria

N_0 is the initial number of bacteria

t is the growth period in hours

The initial number of bacterial cells was 900.

After 2 hours, there were 14 000 bacterial cells in the culture.

Calculate the growth rate constant, k.

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

(3)

Answer .....

(c) (i) State **two** abiotic variables that could affect the growth rate of these bacteria.

(2)

First variable

.....

Second variable

.....

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

.....

.....

.....

.....

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

.....

.....

.....

.....

(Total for Question 2 = 9 marks)

3 The photograph shows a marine worm, *Nereis pelagic*, extending its body from a burrow in the sand.

(Source: © Frank Hecker/Alamy Stock Photo)

Magnification ×1

This animal is found in the Sea of Japan. This animal feeds on organic particles in mud and sand habitats.

A scientist observed that these animals respond to a sudden increase in light intensity by withdrawing into their burrows.

The animals then extend their bodies to continue feeding.

The scientist selected 11 animals living in mud and 11 animals living in sand.

Each animal was exposed to one burst of bright light.

The time in seconds before beginning to extend their bodies from their burrows was then recorded.

Mud habitat

14.8	8.2	9.9	11.6	12.0	14.2	10.7	11.2	8.9	12.1	12.9

Sand habitat

14.0	7.4	9.2	12.6	10.7	7.8	8.0	11.1	10.7	10.8	11.2

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

(1)

.....

.....

.....

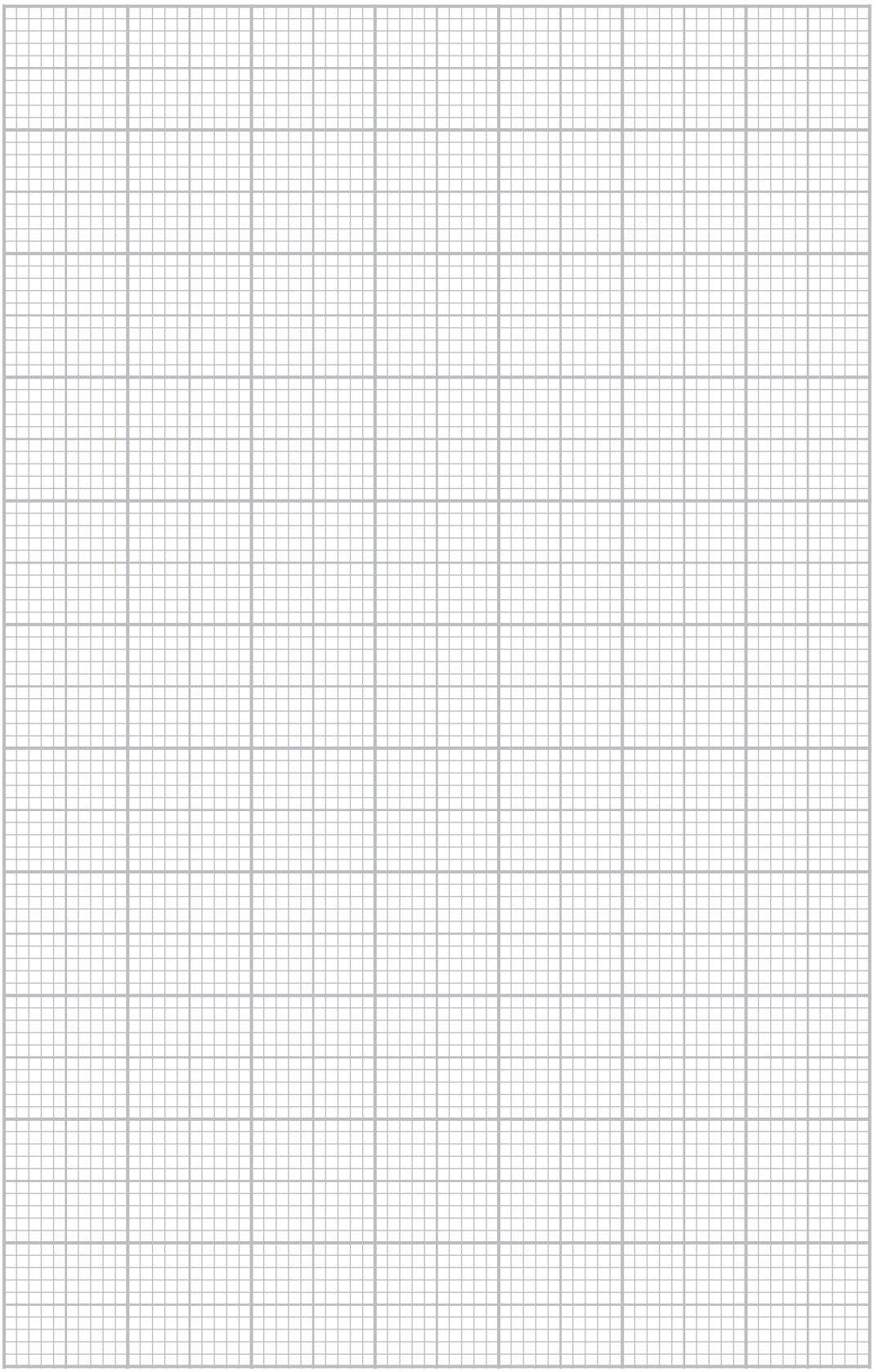
.....

(b) (i) Draw a suitable table to display the **data** and your calculated **means** for time before extension in mud and sand habitats.

(3)

(b) (ii) Draw a suitable graph to display your calculated **means** and the variability of the data, for these two groups of animals.

(3)



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(c) The 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 habitat

n is the number of samples for each habitat

$(S_A)^2 = 4.17$ and $(S_B)^2 = 4.22$

(i) Calculate the value of *t*.

(3)

Answer .....

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

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

Explain the conclusion that can be drawn from this investigation.

Use your graph, your calculated t value and the table of critical values to support your answer.

(3)

(d) This animal has light sensitive pigments called opsins.

Suggest how opsins allow the animals to respond in this investigation.

(2)

(Total for Question 3 = 15 marks)

4 The photograph shows a flightless grasshopper, *Brachaspis robustus*.

(Source: © Davide Bonora/Shutterstock)

This endangered species is only found in one small part of New Zealand.

These grasshoppers are approximately 4 cm long.

The grasshoppers are most active between November and March.

The grasshoppers are camouflaged so they can only be seen when they move.

A student decided to compare the population of grasshoppers living on an unused gravel road and a natural gravel area.

The student formed the following hypothesis:

The population of *B.robustus* in the natural gravel area will be larger than the population on an unused gravel road.

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

(a) Describe preliminary practical work that you might undertake to find a suitable method for observing these grasshoppers to 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 **three** limitations of your proposed method.

(3)

(Total for Question 4 = 17 marks)

TOTAL FOR PAPER = 50 MARKS

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