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.*
- 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.*
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

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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Answer ALL questions.

1 The photograph shows part of a field of Kenaf plants, *Hibiscus cannabinus*.



(Source: © Design Pics Inc / Alamy Stock Photo)

Crops of Kenaf plants are grown throughout Asia.

Several products are extracted from these plants:

- oil can be extracted from the seeds and this oil can be used as a biofuel
- fibres can be extracted from the stems and used to make sustainable materials.

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(a) Describe an experiment to measure the tensile strength of fibres that have been extracted from these plants.

(6)

(b) Cellulose is a major component of plant fibres.

Describe the structure of a cellulose molecule.

(3)

(c) Give **one** reason why the use of biofuels can reduce the effects of climate change.

(1)

(Total for Question 1 = 10 marks)

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2 The photograph shows a garden snail, *Helix aspersa*. This species is endemic to western Europe.



(Source: © Max Mumby / Alamy Stock Photo)

Snails feed on plants in warm, moist conditions.

In dry conditions, snails seal the entrance to their shell with a membrane.

The photograph shows this membrane.

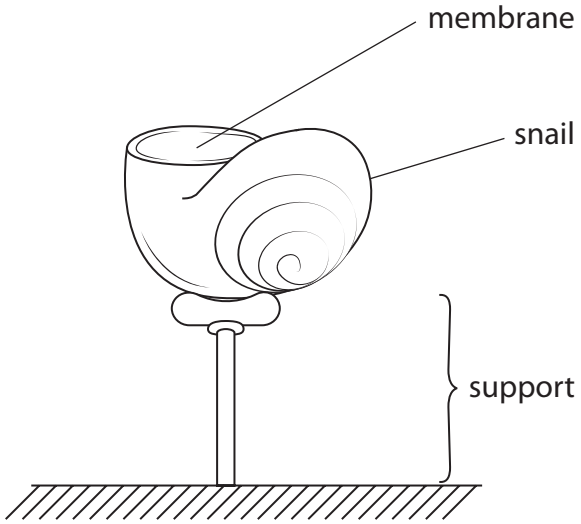


(Source: © Premaphotos / Alamy Stock Photo)

A student investigated the volume of water needed to stimulate snails to break through the membranes at the entrance to their shells.

The student used the following method.
A group of 15 snails with membranes was used in this investigation.

The diagram shows how each snail was held upside down.



Each snail had two drops of water added to the membrane every minute.

The time taken for each snail to break through the membrane was recorded.

(a) Suggest **one** reason why the student thought it was ethical to use snails in this investigation.

(1)

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

Number of drops of water added	40	80	120	160	200
Total number of snails breaking through the membrane	1	4	7	9	10

The mean diameter of each spherical drop of water was 3.0 mm.

Calculate the volume of water added to a snail in one minute.

The volume of a sphere can be calculated using the formula:

$$V = \frac{4}{3}\pi r^3$$

Give your answer in mm^3, to two significant figures.

(3)

Answer ..... mm^3

(c) (i) Give **two** abiotic variables, other than the independent variable, that could affect this experiment.

(2)

1 .....

2 .....

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

Variable .....

State how this variable could be controlled.

(1)

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(iii) Suggest the effect that not controlling this variable could have on the results.

(1)

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(d) The student decided to repeat the investigation using the same apparatus but adding four drops of water every minute.

There was no significant difference in the results when the number of drops added each minute doubled.

Suggest why this did **not** have an effect on the time it took the snails to break through the membrane.

(2)

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(Total for Question 2 = 10 marks)

3 The photograph shows a species of mayfly nymph. Mayfly nymphs live in streams and rivers on every continent except Antarctica.



(Source: © NaturePics / Alamy Stock Photo)

Many species of mayfly nymph are found in unpolluted streams.

All mayfly species have a three-pronged tail.

There are fewer species and lower numbers of each species in polluted streams.

A student read a report that low levels of chlorpyrifos (an insecticide) may have entered some streams.

The student used the method shown in the diagram to collect mayfly nymphs.

Samples were collected from unpolluted stream **A** and polluted stream **B**.

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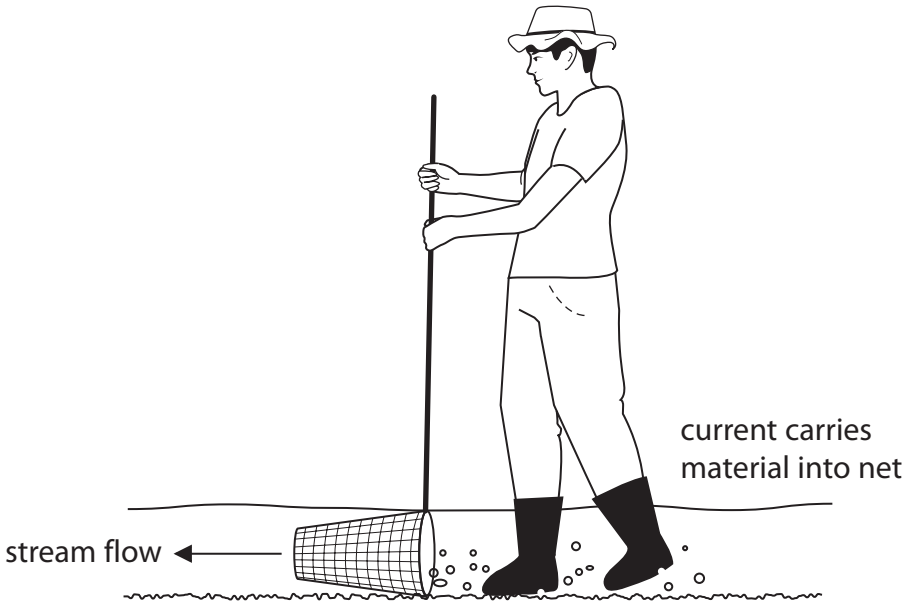
The diagram shows kick sampling in a stream.



The number of mayfly nymphs from each kick sample was recorded.

The student's results:

Stream **A**

27 37 24 45 34 38 49 61 40 20 28 38 42 25 32

Stream **B**

25 16 34 12 35 26 43 51 26 24 36 26 49 52 19

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

(1)

(b) Draw a suitable table to display the **raw data** and your calculated **means** for stream **A** and stream **B**.

(3)

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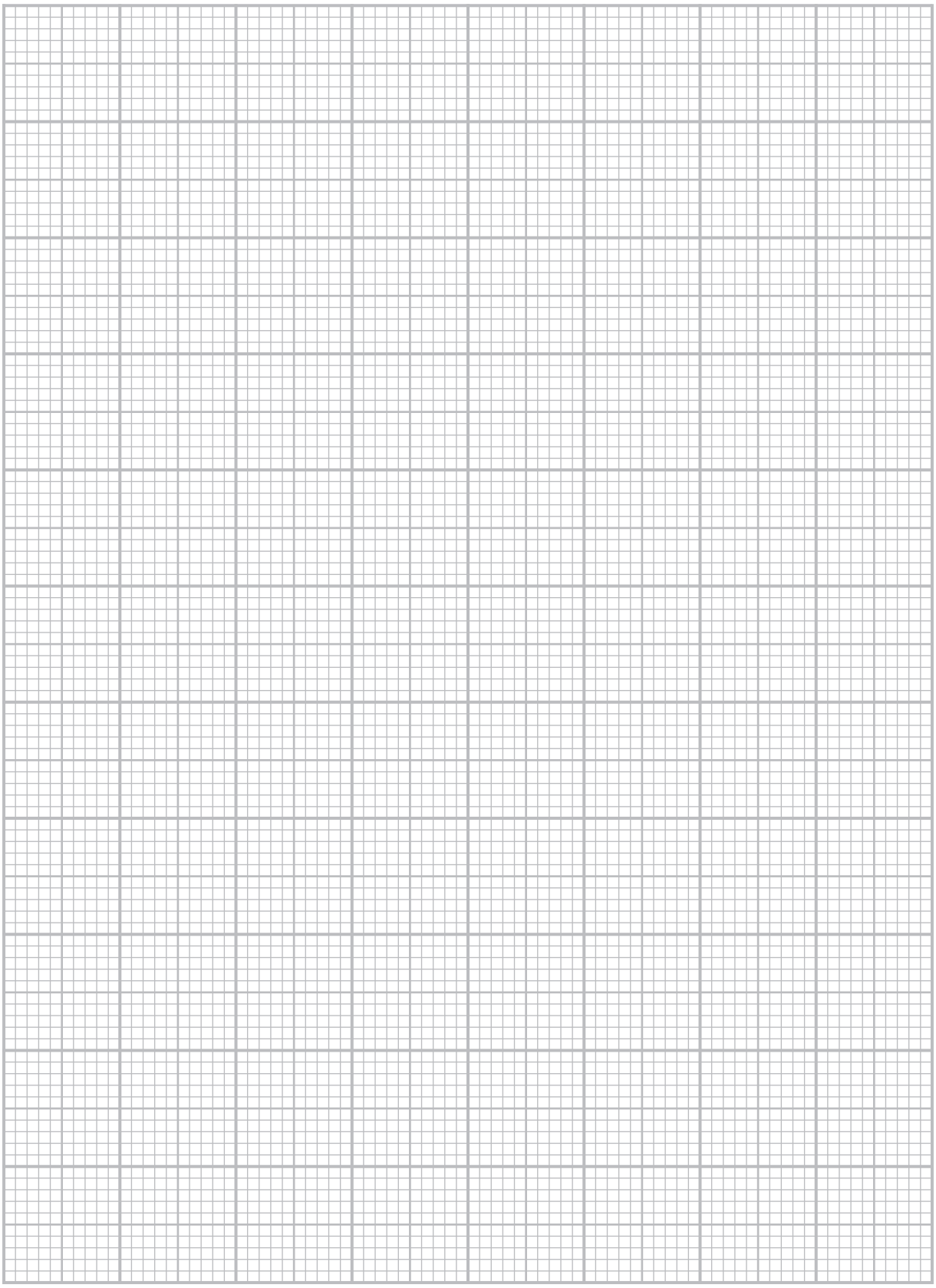
(c) Plot a graph to show the mean number of mayfly nymphs for stream **A** and stream **B**.

Include an indication of the variability of the data.

(3)



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

n is the number of samples for each stream

$\left(S_A\right)^2 = 116$ and $\left(S_B\right)^2 = 160$

(i) Calculate the value of *t*.

(3)

Answer .....

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(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
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

Comment on the results of this investigation.

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

(3)

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

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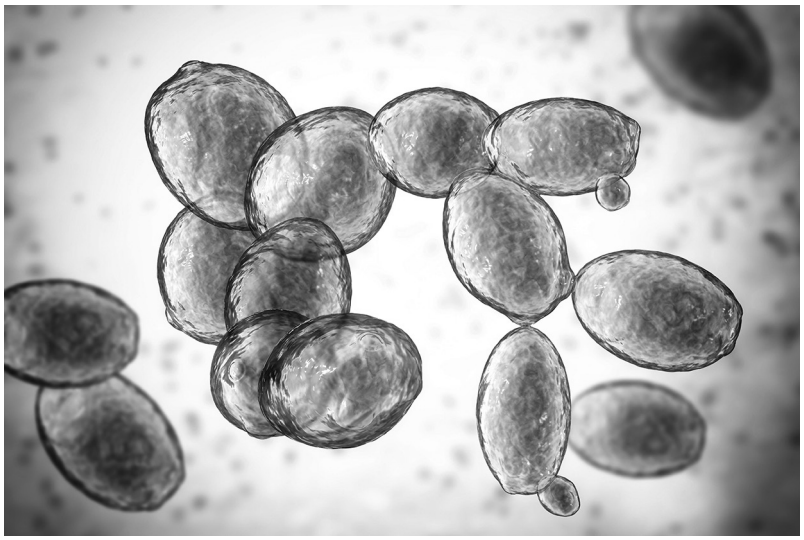
(Total for Question 3 = 15 marks)

4 The photograph shows yeast cells.



(Source: © Science Photo Library / Alamy Stock Photo)

In suitable conditions yeast cells respire and multiply.

A student formed the following hypothesis:

'the higher the temperature, the faster the rate of respiration'

Plan an investigation to test this hypothesis.

Your answer should give details under the following headings.

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(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.

(8)

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

(3)

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

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(Total for Question 4 = 15 marks)

TOTAL FOR PAPER = 50 MARKS

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