Cambridge Pre-U

Cambridge International Examinations
Cambridge Pre-U Certificate

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY (PRINCIPAL) **9790/02**

Paper 2 Data Analysis and Planning **May/June 2017**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Section B
Answer the question.
Write your answer in the space provided on the Question Paper.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section A	
Section B	
Total	

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 3 Pre-U Certificate.

This document consists of **13** printed pages and **3** blank pages.

CAMBRIDGE International Examinations

Answer **all** questions.

Section A – Data Analysis

1 A student carried out an experiment to investigate muscle contraction.

- Six thin strips of fresh skeletal muscle tissue were cut to similar lengths.
- Each strip was placed on a white tile, together with some buffer solution.
- The initial length of each strip was measured using a ruler.
- A small volume of a test solution was added to each strip of muscle. Six different test solutions were used, as shown in Table 1.1.
- After five minutes, the final length of each strip was measured.

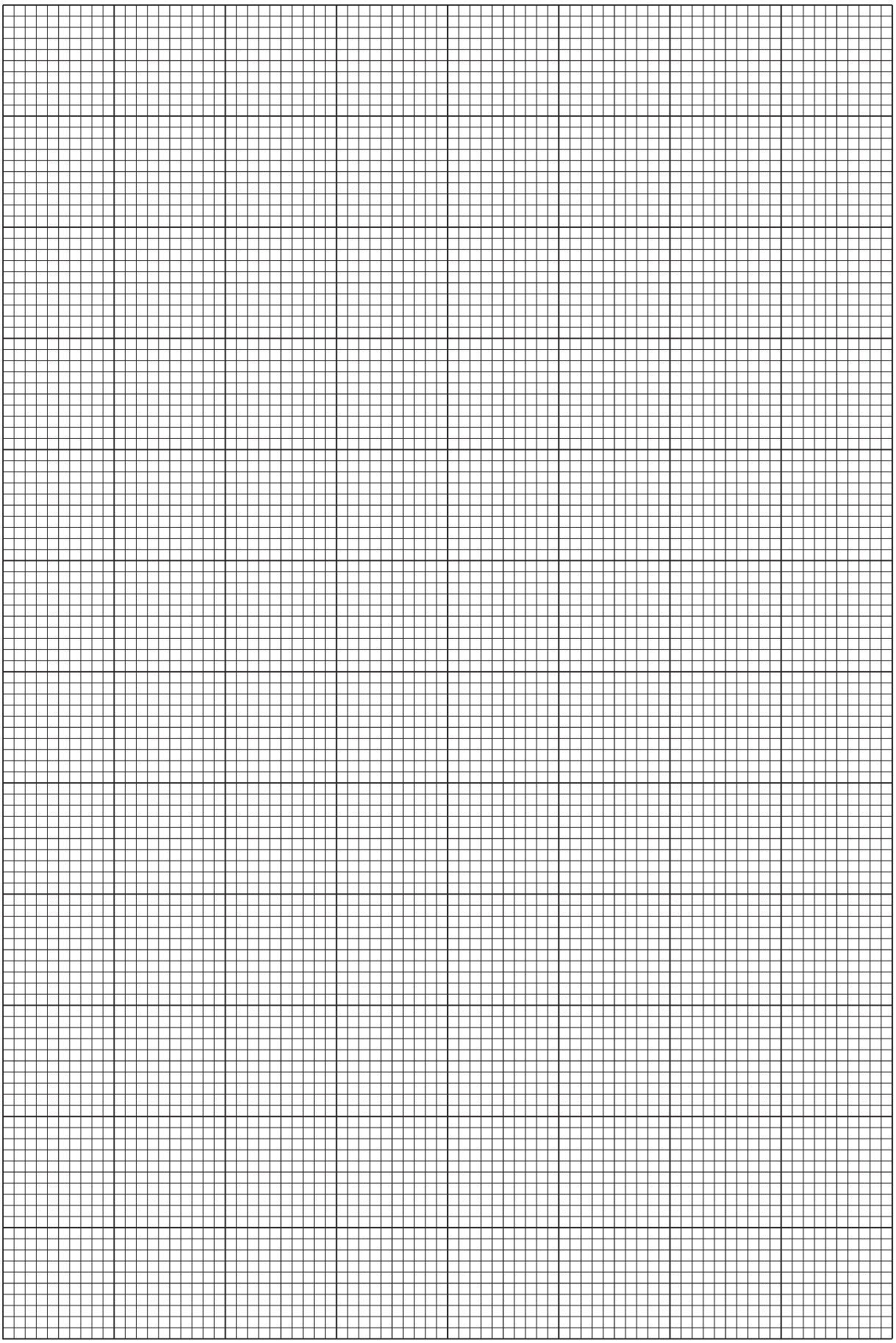
The results are shown in Table 1.1.

Table 1.1

	test solution added					
	1.00 $mg\,dm^{-3}$ ATP	0.50 $mg\,dm^{-3}$ ATP	0.25 $mg\,dm^{-3}$ ATP	0.10 $mg\,dm^{-3}$ ATP	boiled 1.00 $mg\,dm^{-3}$ ATP	0.10 $g\,dm^{-3}$ glucose
initial length / mm	40	39	39	40	39	41
final length / mm	28	29	32	36	28	41
change in length / mm	–12	–10	–7	–4	**(i)**	0
percentage change in length	–30.0	–25.6	–17.9	**(ii)**	**(iii)**	0

(a) Complete boxes **(i)**, **(ii)** and **(iii)** in Table 1.1. [3]

(b) Use the grid provided on the opposite page to display, in a suitable way, the percentage change in length results for the six test solutions shown in Table 1.1. [5]



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(c) (i) Describe **and** explain the results when different concentrations of unboiled ATP solution were added to the muscle strips.

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.....[5]

(ii) Describe **and** explain the results when boiled ATP solution was added to a muscle strip and when glucose solution was added to a muscle strip.

boiled ATP .....

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glucose .....

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[4]

(d) Identify **two** limitations of this experiment.

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[Total: 19]

2 *Alloteropsis semialata* is a species of grass that has two distinct types, each carrying out photosynthesis using a different pathway: C3 and C4.

An experiment was carried out in which a group of each type of *A. semialata* was exposed to high intensity artificial sunlight and a temperature of 30 °C at different concentrations of carbon dioxide. All other factors were kept constant. The uptake of carbon dioxide over a 30-minute period was measured using a sensitive gas probe. The rate of photosynthesis (per unit area of leaf) was determined from the measurements.

Fig. 2.1 shows the results for the two different types of *A. semialata*.

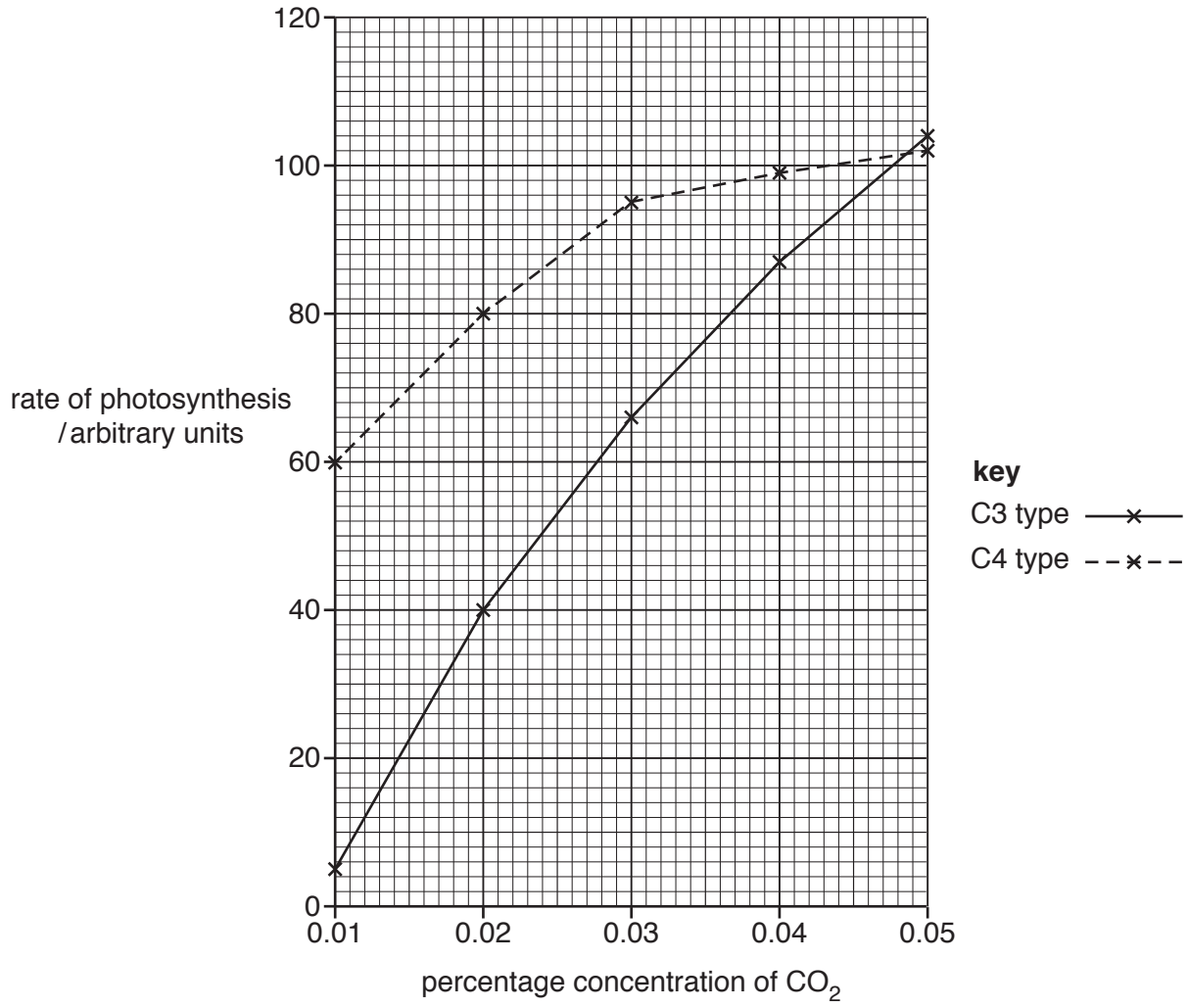

Fig. 2.1

(a) With reference to Fig. 2.1, compare the results for the C3 and C4 types of *A. semialata*.

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(b) Suggest an explanation for the differences between the results for the C3 and C4 types of *A. semialata*.

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(c) A further study was carried out to investigate the rate of transpiration of the two types of *A. semialata* over a 12-hour period in the same conditions. The atmospheric carbon dioxide concentration for both types of *A. semialata* was 0.01%. The results are shown in Table 2.1.

Table 2.1

	A. semialata C3 type	*A. semialata* C4 type
rate of transpiration / mmol H_2O m^{-2} s^{-1}	8.1	2.3

(i) Explain why the rate of transpiration was measured per unit area of leaf.

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(ii) Suggest reasons for the difference in the rates of transpiration observed.

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(d) Suggest **and** explain when the development of a C4 photosynthetic pathway could be an evolutionary advantage for *A. semialata*.

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[Total: 16]

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Section B – Planning

3 The enzyme succinate dehydrogenase (SDH) catalyses the conversion of succinate into fumarate as part of the Krebs cycle. This results in the release of two hydrogen ions and the subsequent reduction of FAD.

Malonate has a very similar structure to succinate and has been shown to act as a reversible inhibitor of SDH in freshly isolated cells from pea seeds.

Methylene blue is a redox reagent which changes colour from blue to colourless when reduced.

Plan an investigation to determine whether malonate is a competitive or a non-competitive inhibitor of SDH.

You are provided with the following materials. Choose your materials from this list. You may **not** use any additional materials.

- freshly isolated pea cells suspended in a buffered solution
- 1.0% malonate solution
- 5.0% succinate solution
- 0.005% methylene blue solution
- distilled water
- beakers and flasks of different sizes
- electronic timer
- thermometer
- colorimeter and tubes
- thermostatically controlled water-baths
- pipettes and pipette fillers
- filter funnels and filter papers
- syringes of different sizes
- glass rods
- pH meter or pH papers
- test-tubes and boiling tubes
- labels for test-tubes and boiling tubes
- racks and holders for test-tubes and boiling tubes
- Bunsen burner, gauze and tripod

Your plan should:

- include a clear statement of the hypothesis or prediction
- identify the key variables
- give full details and explanations of the procedures that you would adopt to ensure that the results are as precise and repeatable as possible
- show how you would present and analyse your results
- include a brief risk assessment
- be written in clear scientific language.

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[Total: 25]

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