

**ADVANCED GCE
BIOLOGY**

Practical Examination 2 (Part B – Practical Test)

TUESDAY 22 MAY 2007

2806/03/TEST

Afternoon

Time: 1 hour 30 minutes

Additional materials: Candidate's Plan (Part A of the Practical Examination)
Electronic calculator
Ruler (cm/mm)



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Candidate
Name

Centre
Number

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INSTRUCTIONS TO CANDIDATES

- Write your name, Centre Number and Candidate Number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read the instructions and questions carefully before starting your answers.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- **WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. ANSWERS WRITTEN ELSEWHERE WILL NOT BE MARKED.**

INFORMATION FOR CANDIDATES

- In this Practical Test, you will be assessed on the Experimental and Investigative Skills:
 - Skill I Implementing
 - Skill A Analysing evidence and drawing conclusions
 - Skill E Evaluating.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
Planning	16	
1	28	
2	16	
TOTAL	60	

This document consists of **9** printed pages, **2** blank pages and a Report Form.

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Answer **all** the questions.

Question 1 [55 minutes]

The purpose of this investigation is to find the effect of different concentrations of leaf extract on the rate of the light-dependent stage of photosynthesis.

The transfer of electrons and hydrogen ions to molecules called hydrogen acceptors takes place during the light-dependent stage. An acidified purple-pink solution of potassium manganate VII (potassium permanganate) can act as a hydrogen acceptor and can be reduced to a colourless solution of manganese II ions during the light-dependent stage.

In this investigation, you will mix samples of a leaf extract in dilute sucrose solution with acidified potassium manganate VII and record how long it takes for the purple-pink colour to disappear.

Proceed as follows:

- 1 You are provided with five boiling tubes labelled **A** to **E**. Use a 5 cm³ syringe and a 10 cm³ syringe to make up five different mixtures of leaf extract and sucrose solution as shown in the table below.

tube	volume of leaf extract/cm ³	volume of sucrose solution/cm ³	concentration of leaf extract/arbitrary units
A	5.0	5.0	50
B	4.0	6.0	40
C	3.0	7.0	30
D	2.0	8.0	20
E	1.0	9.0	10

Read steps 2 to 8 and prepare to record your results in the space provided on page 4.

- 2 Use a 1 cm³ syringe to add 1 cm³ of sulphuric acid to tube **A**.
- 3 Pour the contents of tube **A** into the flat-bottomed tube. Place this tube on a white tile so that the tube is about 20 cm in front of the bench lamp. Switch on the bench lamp and shine the light at the extract.
- 4 Use a clean 1 cm³ syringe to add 1 cm³ of potassium manganate VII to the flat-bottomed tube. Start a stopwatch, stop clock or bench timer and shake the tube to mix the contents.
- 5 Record the time taken for the purple-pink colour to disappear.
Ignore any purple-pink colour that may remain at the surface.
- 6 Calculate the relative rate of reaction using the following formula.
Relative rate of reaction = 1000/t where t = time in seconds.
If the purple-pink colour has not disappeared after ten minutes record the relative rate of reaction as 0.
- 7 Empty the contents of the flat-bottomed tube into the beaker labelled waste. Rinse the tube with distilled water.

8 Repeat steps 2 to 7 with each of the remaining tubes B to E.

(a) Record your results in a suitable form in the space below.

(b) Draw a graph on page 5 opposite to illustrate your results.

(c) Describe **and** explain the pattern of your results.

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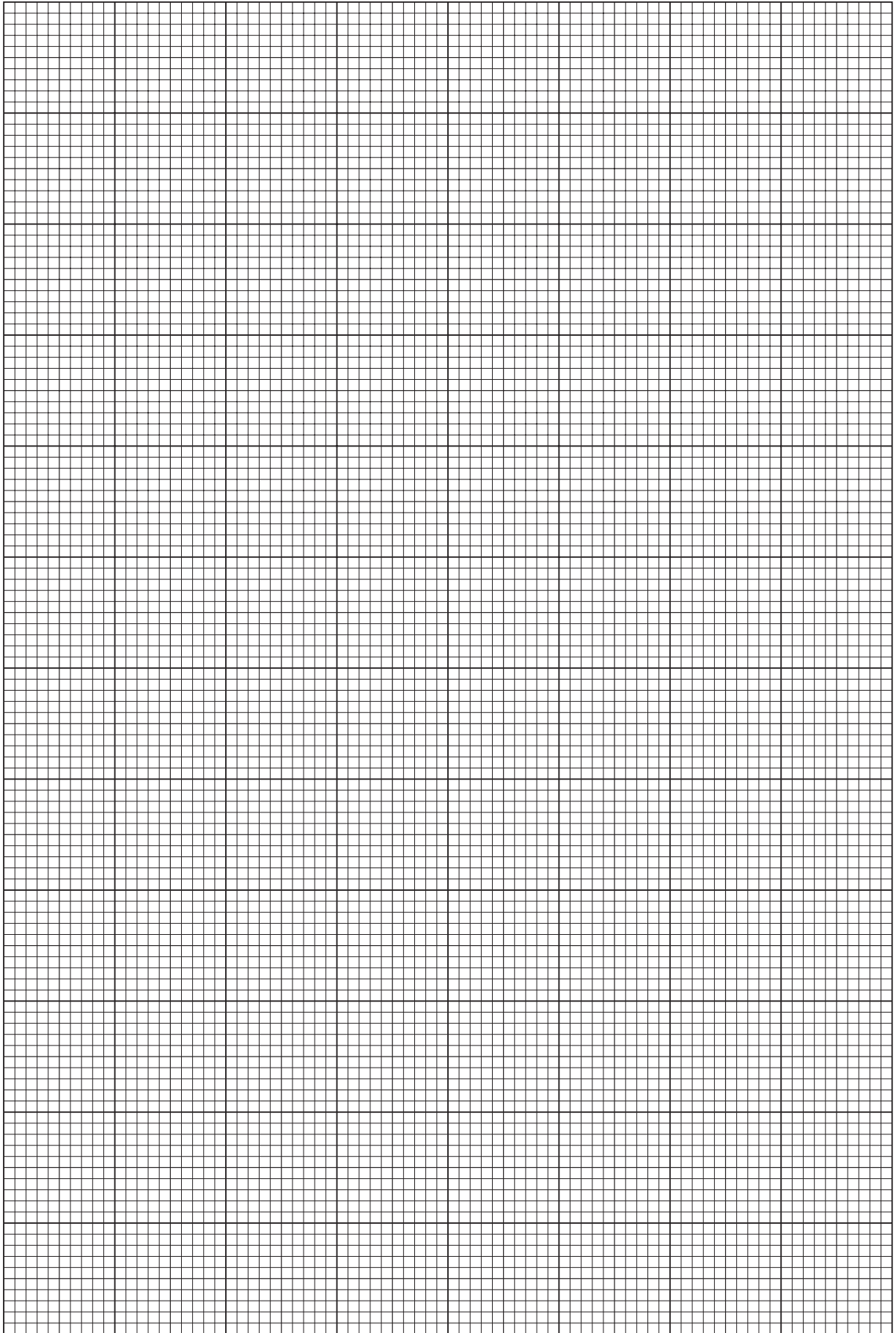
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(d) The leaf extract was prepared in such a way that the chloroplasts remained intact.

(i) Explain why sucrose solution was used to dilute the leaf extract instead of distilled water.

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(ii) Suggest the effect on your results if distilled water had been used to dilute the leaf extract.

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(e) State **two** controls that should have been included in this investigation. Explain why each control is necessary.

Control 1

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Control 2

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Question 2 [35 minutes]

Stomata, in the epidermis of leaves, are responsible for the exchange of gases and the release of water vapour. A pair of guard cells controls the opening and closing of each stoma. In the guard cell membrane there is a transport protein. During the opening of the stomata, this protein uses energy from the hydrolysis of ATP to move protons (H^+) out of guard cells. This has two effects.

- Because protons are positively charged, their removal from the guard cells causes the interior of the cells to become negatively charged relative to the exterior. Because of this, some positive ions such as K^+ move into the interior of the cells lowering the water potential inside the cells.
- The pH inside the cell is increased.

You are provided with leaf samples that are soaking in the following solutions.

solution **X**: 0.1 mol dm^{-3} potassium chloride at pH 7.0

solution **Y**: 0.1 mol dm^{-3} sodium chloride at pH 7.0

solution **Z**: 0.1 mol dm^{-3} potassium chloride at pH 4.5

Proceed as follows:

- 1 Use a pair of forceps to remove the leaf from solution **X** and use scissors to cut out an area up to $1 \text{ cm} \times 1 \text{ cm}$. Transfer this to a slide ensuring **that the lower epidermis is uppermost**. Use a dropping pipette to add a drop or two of solution **X** to the leaf surface. Lower a cover slip over the leaf being careful to exclude any air bubbles.
- 2 Use the $\times 10$ objective of a microscope to locate the stomata. Count the **total** number of stomata that are visible and the total number that are fully **open** in the same field of view. Ignore any that you are doubtful about. Repeat this for another two areas of the leaf. Calculate the mean percentage of open stomata.
- 3 Repeat steps 1 and 2 for leaves from solutions **Y** and **Z** using clean slides and cover slips on each occasion. *You must keep slide **Z** in order to answer (b) on page 10.*

(a) (i) Record your results in the table below.

leaf	pH	sample	total number of stomata	total number of open stomata	mean percentage of open stomata/%
X	7.0	1			
		2			
		3			
Y	7.0	1			
		2			
		3			
Z	4.5	1			
		2			
		3			

(ii) Explain your results.

X

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Y

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Z

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(iii) Guard cells, unlike other cells in the epidermis, have chloroplasts. These chloroplasts have grana but lack the enzymes necessary for the **light-independent stage** of photosynthesis (Calvin cycle).

With reference to your results, suggest why guard cells have chloroplasts if they do not carry out the **light-independent stage** of photosynthesis (Calvin cycle).

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THIS QUESTION CONTINUES ON PAGE 10

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- (b) Make a **high power** drawing of two guard cells and the epidermal cells on either side of each guard cell from the leaf in solution **Z**.

[Total: 16]

END OF QUESTION PAPER

11
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REPORT FORM

The teacher responsible for the supervision of the Practical Test is asked to report on the following:

- (a) Any particular difficulties encountered in making preparations for the Practical Test.

- (b) Whether it was necessary to make any substitutions for the materials listed in the Instructions. Submit a copy of any results obtained by teacher(s) or technician(s), using the substituted materials, on top of the candidates' scripts.

- (c) Any difficulties experienced by this candidate due to deficient materials or faulty apparatus. If so, give brief details.

- (d) Any assistance given to this candidate with respect to colour blindness or other physical handicap. If so, give brief details.

Other cases of hardship, for example illness or temporary disability, should be reported directly to OCR, by the Examinations Officer, as a normal Application for Special Consideration.

Signed

Information that applies to **all** candidates should be given on the first candidate's script **only** or supplied on a separate sheet placed on top of the candidates' scripts.

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