OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
Advanced GCE

BIOLOGY 2806/03/TEST

Practical Examination 2 (Part B – Practical Test)

Thursday **27 JANUARY 2005** Morning 1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
Candidate's Plan (Part A of the Practical Examination)
Electronic calculator
Ruler (cm/mm)

Candidate Name	Centre Number	Candidate Number

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers in the spaces provided on the question paper.
- Read the instructions and questions carefully before starting your answers.

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	**26**	
2	**18**	
TOTAL	**60**	

This question paper consists of 9 printed pages, 2 blank pages, a Report Form and an Insert.

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Answer **all** the questions.

Question 1 [50 minutes]

The purpose of this investigation is to find the effect of different wavelengths of light 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.

Dichloro-phenol-indophenol (DCPIP), a blue dye, can act as a hydrogen acceptor, which turns colourless when it is reduced during the light-dependent stage.

$$\text{Electrons and hydrogen ions from water} + \underset{\text{(blue)}}{\text{DCPIP}} \longrightarrow \underset{\text{(colourless)}}{\text{reduced DCPIP}}$$

In this investigation, you will mix samples of a leaf extract with a **reaction medium** containing DCPIP. You will then expose the samples to different wavelengths of light and record any colour changes.

Proceed as follows:

1. You are provided with a cold, buffered extract of leaf material in a flat-bottomed tube.

2. Remove a sample of the leaf extract by inserting a length of capillary tube into the flat-bottomed tube and removing the capillary tube immediately. Lay the capillary tube on a white tile. This is tube **1**. Use the marker pen to write on the tile and identify the tube.

   Use tube **1** as a colour standard with which to compare the contents of the capillary tubes you will prepare later.

3. Using the dropping pipette and gently shaking the flat-bottomed tube, add sufficient drops of the reaction medium provided to the leaf extract until it **just turns blue-green**.

   Immediately wrap the flat-bottomed tube with foil and add a foil cap, which can be easily removed when necessary, so that the mixture of extract and dye is kept in the dark. See Fig. 1.1.

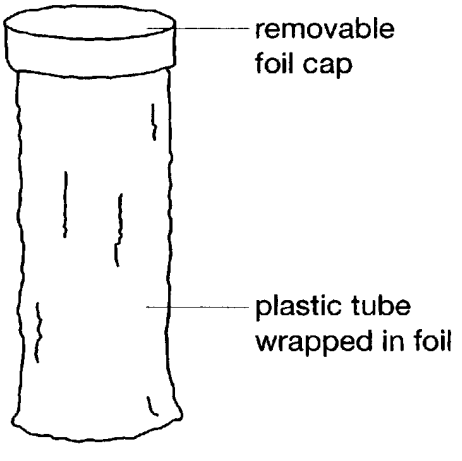

Fig. 1.1

4. Take a second capillary tube and remove a sample from the mixture. Quickly wrap the capillary tube completely in foil to prevent any exposure to light. This is tube **2**. Lay tube **2** on the tile next to tube **1**.

5. Take three more capillary tubes and stand them together in the mixture. Quickly place these three tubes on the white tile. Quickly cover one with the green filter and one with the red filter.

   - The tube under the green filter is tube **3**.
   - The tube under the red filter is tube **4**.
   - The uncovered tube is tube **5**.

   At this stage the contents of these three tubes should be dark blue-green. If the contents of the tubes appear green **with no blue colour**, repeat the procedure from step 3 adding a few more drops of reaction medium to the extract.

6. Direct a light from the lamp towards the capillary tubes. Note the colour of the contents every two minutes for at least ten minutes.

   Tube **2** should be exposed to the light for the minimum possible time when being examined.

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

Use the terms dark blue-green, dark green, green and pale green to distinguish gradations of colour.

[Turn over

For Examiner's Use

(b) Tubes 1 and 2 are included as controls. Explain the reasons for using them.

tube **1** .....

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tube **2** .....

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(c) What further control should have been set up and why?

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(d) State **two** variables which have not been controlled in this investigation.

1 .....

2 .....

(e) Explain why the leaf extract was buffered and chilled.

buffered .....

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chilled .....

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(f) Explain the difference between the results you obtained for tubes **5** and **2**.

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(g) Explain the difference between the results you obtained for tubes **3**, **4** and **5**.

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(h) The leaf extract was prepared using a solution with the same water potential as the leaf cells. The reaction medium has a higher water potential than the leaf extract. Fig. 1.2, on the insert, shows an electron micrograph of chloroplasts after the addition of the reaction medium.

(i) How do these chloroplasts in the reaction medium differ in appearance from normal chloroplasts?

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(ii) Suggest why it is an advantage to use chloroplasts, such as those shown in Fig. 1.2, in this investigation rather than normal chloroplasts.

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[Total: 26]

Question 2 [40 minutes]

This question is about sun and shade leaves.

Leaves that are not regularly exposed to full sunlight often show adaptations for growing at relatively low light intensities. Such leaves are known as shade leaves.

Leaves that grow in full sunlight are called sun leaves.

You are provided with a shade leaf and a sun leaf from ivy, *Hedera helix.*

Proceed as follows:

1. Cover a small area (about 1 cm^2) of the **lower** epidermis of the **shade leaf** with a **thin** film of nail varnish. Make sure that you do not cover an area with large veins.

2. Cover a similar area of the sun leaf with nail varnish.

3. Put the leaves to one side for at least five minutes to allow the nail varnish to dry.

4. While you are waiting, label two slides 'sun' and 'shade' and then read the rest of the question carefully. You may be able to answer parts **(b)** and **(d)**.

5. After five minutes, carefully remove the films from the leaves and place them on their respective slides. Gently place a cover slip on each film. No water is required.

6. Use the **high power** objective of your microscope to observe the film from the **sun leaf**.

(a) **(i)** Make a drawing of a stoma, its guard cells and three adjacent epidermal cells. You may find that changing the illumination and focussing will help to define the cells more clearly.

(ii) State **one** major limitation of the technique that you have used for observing the guard cells.

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(b) When the rates of respiration and photosynthesis are the same, there is no net gas exchange between leaves and the atmosphere. The light intensity at which this happens is called the light compensation point. The time taken for a plant to reach its light compensation point after being removed from the dark is called the compensation period. This is usually shorter for shade plants than for sun plants.

Suggest how the density of stomata in sun and shade leaves may be different and explain why.

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(c) Continue to use the **high power** objective of your microscope to observe the film of the **sun leaf**.

Count the total number of stomata visible in one high power field of view. Record this number in the table below.

Move the slide a little and make another count. Record the number in the table.

Repeat this procedure three more times and record your results. Calculate the mean of your results.

Repeat this procedure for the film that you made from the **shade leaf**.

count	number of stomata	
	sun leaf	shade leaf
1		
2		
3		
4		
5		
mean		

(d) Some students carried out a similar investigation on sun and shade leaves of ivy growing in woodland. They carried out the same procedure as you have done. When the students analysed their results, they found that there was very little difference between the mean numbers of stomata for the two types of leaves. Other students were critical of the investigation saying that the results were not reliable.

Identify limitations of the procedure to find out if there is any difference between the numbers of stomata on the two types of leaf.

Explain how the investigation might be improved to obtain more reliable results.

limitations .....

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improvements .....

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[Total: 18]

END OF QUESTION PAPER

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. If so, submit a copy of the results obtained by a teacher or technician, using the substituted materials, on top of the candidates' scripts.

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

(d) Any assistance given to the 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**.
