OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

BIOLOGY 2806/03/TEST

Practical Examination 2 (Part B – Practical Test)

Tuesday **25 MAY 2004** 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	**28**	
2	**16**	
TOTAL	**60**	

This question paper consists of 11 printed pages and a Report Form.

Registered Charity Number: 1066969
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Answer **all** the questions.

Question 1 [55 minutes]

The purpose of this investigation is to find the effect of temperature on the rate of respiration in yeast.

The successive transfer of hydrogen atoms to molecules called hydrogen acceptors takes place during respiration. Triphenyl tetrazolium chloride (TTC) can act as an **artificial** hydrogen acceptor which turns pink when it is reduced during aerobic respiration.

$$\text{hydrogen atoms from substrate} + \underset{\text{(colourless)}}{\text{TTC}} \rightarrow \underset{\text{(pink)}}{\text{reduced TTC}}$$

You are to mix yeast suspension (to which a fixed concentration of glucose has already been added) with TTC solution and record how long it takes for the reduction of TTC over a range of temperatures between 65 °C and 25 °C. Using your results, you are to plot a graph and calculate the temperature coefficient, Q_{10}.

Proceed as follows:

1. You are provided with two boiling tubes labelled **A** and **B**. Prepare a water bath by half filling a 400 cm^3 beaker with water and maintain the temperature of the water at 65 °C.

2. Using the 10 cm^3 syringes provided, transfer 10 cm^3 of yeast suspension to tube **A** and 1 cm^3 of 0.5% TTC solution to tube **B**. Place both tubes in the water bath for three minutes.

3. After three minutes, add the yeast suspension to the TTC solution. **Gently** mix the contents using a glass rod and return the tube to the water bath.

   Start a stopwatch immediately and record the time **t** for the first appearance of a pink colour.

   Do not shake the tubes while waiting for this to occur.

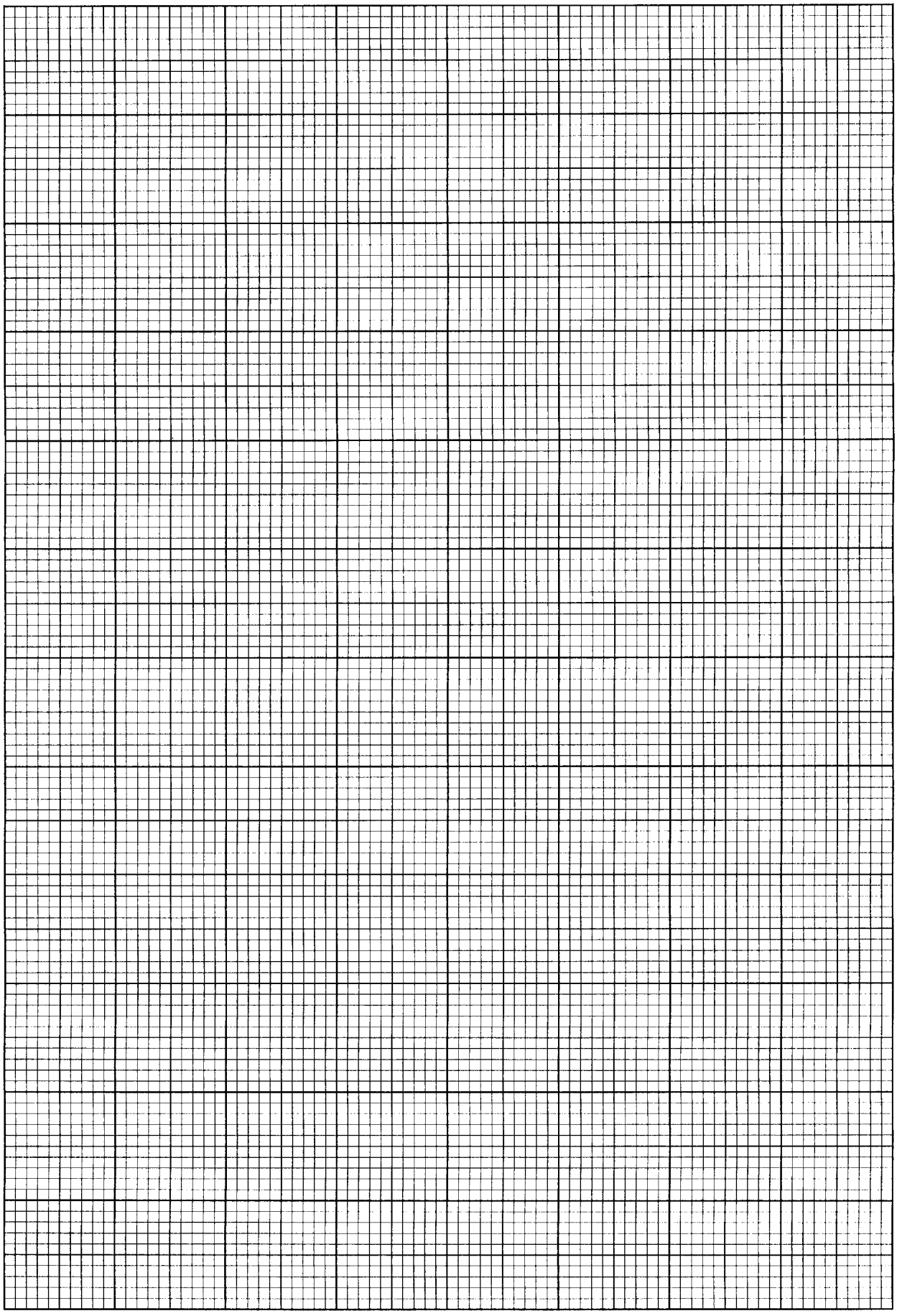
4. Using the formula **1000/t**, determine the rate of the reaction in arbitrary units.

5. Wash out the boiling tubes and reduce the temperature of the water bath by 10 °C to 55 °C. Repeat the procedure in steps 2 to 4 at 55 °C.

6. Repeat steps 2 to 4 at three more temperatures: 45 °C, 35 °C and 25 °C.

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

(b) Plot a graph of your results on the opposite page.



(c) Describe the pattern of results as shown by your graph.

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(d) Dehydrogenase enzymes are involved in the process of aerobic respiration.

Describe the role of dehydrogenases in aerobic respiration.

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(e) In this investigation, TTC was acting as an artificial hydrogen acceptor in the process of aerobic respiration.

Describe the role of **natural** hydrogen acceptors after they have been reduced in aerobic respiration.

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(f) The effect of a 10 °C rise in temperature on the rate of reaction is called the temperature coefficient (Q_{10}).

Using the formula:

$$\text{temperature coefficient } (Q_{10}) = \frac{\text{rate at } 35\,^{\circ}\text{C}}{\text{rate at } 25\,^{\circ}\text{C}}$$

calculate the temperature coefficient (Q_{10}). Show your working in the space below.

Q_{10} = ...

(g) What were the main sources of error in this investigation?

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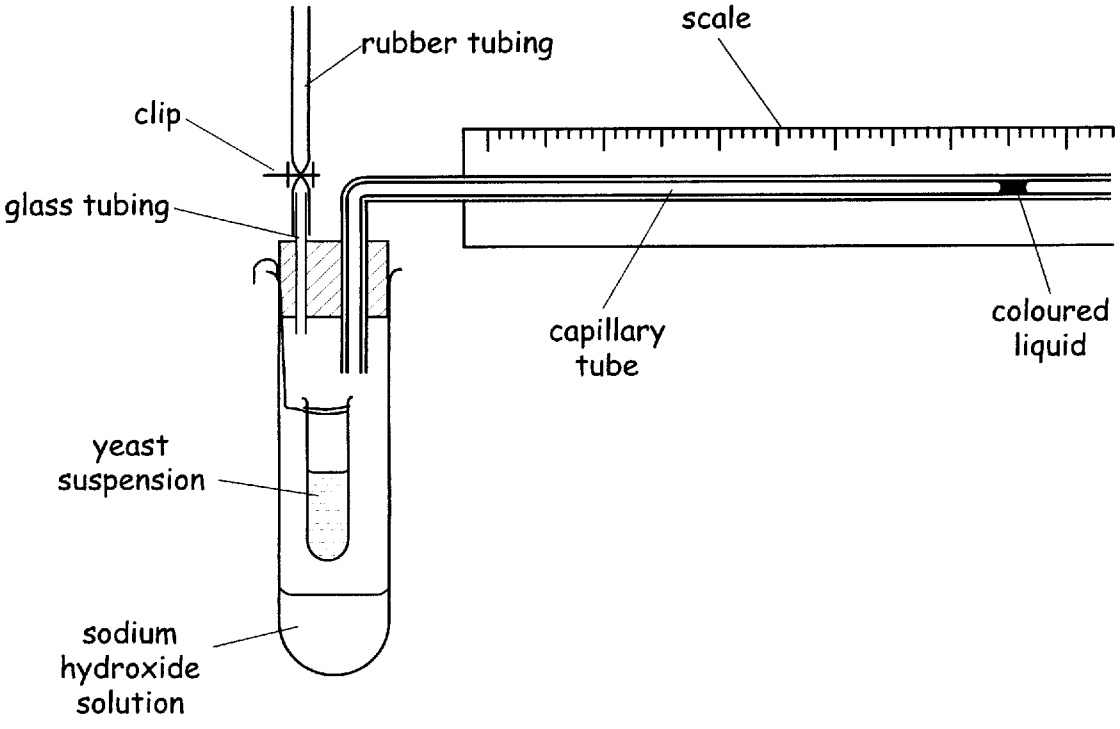
A student determined Q_{10} using an alternative method. The procedure and results are shown below.

- Following the introduction of sodium hydroxide solution (to absorb carbon dioxide gas) into a boiling tube, a small tube containing yeast suspension was placed in the tube.
- A respirometer was set up as shown in the diagram below.
- By dipping the end of the capillary tube into coloured water, a drop was introduced into the end. The boiling tube, with the screw clip open, was placed in a water bath at 25 °C.



- After five minutes, the screw clip was closed. The time taken for the coloured liquid to move 10 mm towards the boiling tube was recorded.
- The procedure was repeated using a range of temperatures and the results (below) were used to draw a graph and determine Q_{10}.

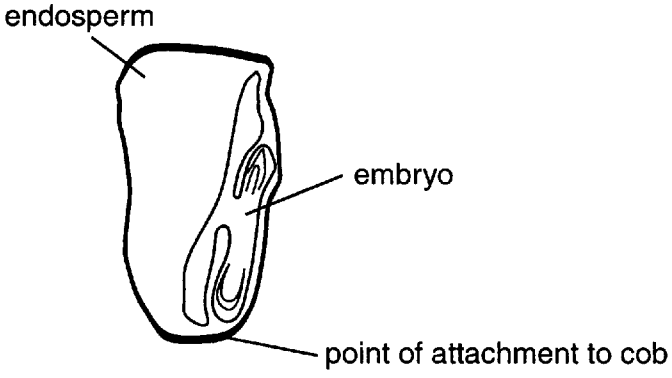
temp / °C	time (t) taken for water droplet to move 10 mm / seconds	relative rate (1000/t)
25	800	1.25
35	400	2.50
45	343	2.92
55	1200	0.83
65	No change after 30 minutes	0.00

(h) Discuss the **advantages** and **disadvantages** of the method used by the student compared with the method that you have used.

[Total : 28]

Question 2 [35 minutes]

Maize grains are similar to wheat and barley grains in that they contain an embryo and an endosperm as shown in Fig. 2.1.



Longitudinal section of a maize grain.

Fig. 2.1

You are provided with iodine solution, which stains starch a dark blue colour and Sudan III, which stains lipids a red colour.

1. Transfer 5 cm^3 of iodine solution to tube **P** and 5 cm^3 of Sudan III to tube **Q**.

2. **Carefully** cut through the long axis of the two soaked maize grains as shown in Fig. 2.2.

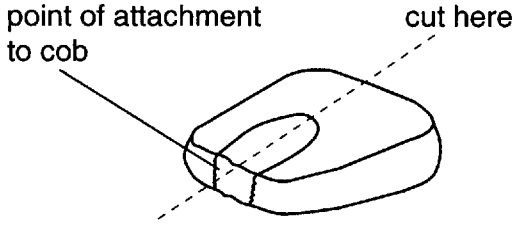


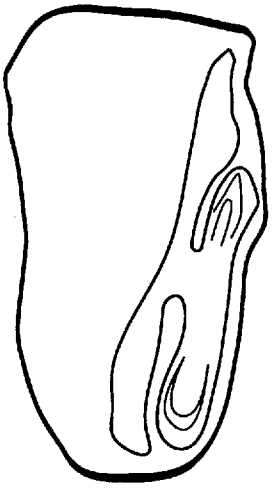
Fig. 2.2

3. Use a hand lens to examine the cut surfaces. The cut surfaces should resemble the drawings shown in Fig. 2.3.
4. Use the forceps to place both halves of one grain in tube **P** for **one minute** and both halves of the other grain in tube **Q** for **fifteen minutes**.
5. After one minute pour the contents of tube **P** into a Petri dish and, using the forceps, transfer the two halves of the grain to a small beaker of water to wash off excess stain. Remove them from the beaker and use a paper towel to dry them. Examine the cut surfaces of the grains.

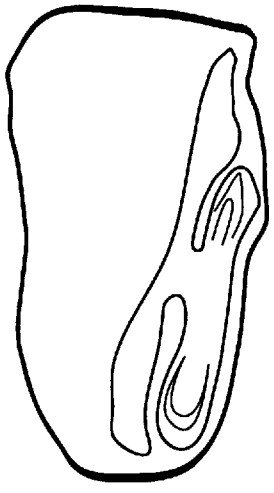
   *While you are waiting for tube **Q** you should continue with part* **(c)** on page 10.

6. After fifteen minutes use the same procedure to remove the two halves of the grain from tube **Q**. Wash off the excess stain and use a paper towel to dry them. Examine the cut surfaces of the grains.

(a) Use the hand lens to observe the cut surfaces of each grain. Indicate clearly on Fig. 2.3, the distribution of the stained areas in each grain.



L.S. maize grain stained with iodine solution.



L.S. maize grain stained with Sudan III.

Fig. 2.3

(b) Iodine and Sudan III indicate the presence of starch and lipids.

(i) Explain why starch and lipids are present in grains such as wheat, barley and maize.

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QUESTION 2 CONTINUES ON PAGE 10

[Turn over

(ii) Describe the distribution of these substances as shown by the stains.

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(iii) Suggest an explanation for the distributions you have described in **(b)(ii)**.

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(c) Take another soaked maize grain. Carefully cut through the short axis of this soaked maize grain, as shown in Fig. 2.4.

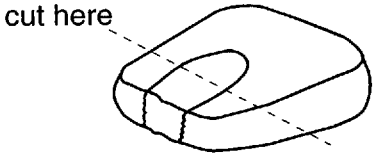

Fig. 2.4

Use a hand lens to observe a cut surface.

(i) Make a plan drawing of the cut surface of the maize grain in the space below.

(ii) Gibberelins are involved in germination. Indicate on your drawing above the parts of the grain where gibberellins

1 are produced,

2 act during germination.

[Total : 16]

END OF QUESTION PAPER