OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
Advanced GCE

BIOLOGY 2806/03/TEST

Practical Examination (Part B): Practical Test

Tuesday **21 MAY 2002** Morning 1 hour 30 minutes

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

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** questions.
- Write your answers in the spaces on the question paper.
- Read each question carefully before starting your answer.

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	25	
2	19	
TOTAL	60	

This question paper consists of 8 printed pages, 3 blank pages and a Report Form.

Registered Charity Number: 1066969

[Turn over

Question 1 [50 minutes]

You are required to investigate some features of the metabolism of yeast.

You are provided with the following mixtures of a standard yeast suspension:

K1 *yeast suspension with an equal volume of 0.2 mol dm^{-3}* ***glucose*** *solution*
K2 *yeast suspension with an equal volume of 0.2 mol dm^{-3}* ***sucrose*** *solution*
K3 *yeast suspension with an equal volume of 0.2 mol dm^{-3}* ***lactose*** *solution*
K4 *yeast suspension with an equal volume of* ***distilled water.***

In addition you have a solution of *triphenyl tetrazolium chloride (TTC).* This is colourless when oxidised. It can be **reduced** to form an *insoluble* red compound.

Note: TTC is corrosive and toxic. Do not get it on your skin. If you should do so wash it off immediately with cold water.

Proceed as follows:

Half-fill a beaker or tin with water.

Adjust its temperature to between 38 and 42 °C.

Maintain the water bath at this temperature.

Label four boiling tubes **K1**, **K2**, **K3** and **K4** respectively.

Stir all the yeast suspensions thoroughly using a glass rod.

To the labelled boiling tubes add **20 cm^3** of the respective yeast suspensions.

Add **2 cm^3** of TTC solution to each tube. Shake the tubes gently to mix the contents.

Fit tubes **K1**, **K2** and **K3** with bungs and delivery tubes. Ensure that the fitting is airtight in each case.

Place all four tubes in the water bath. Position test tubes with water for each of the delivery tubes from **K1**, **K2** and **K3 outside** the water bath as shown for **K1** in **Fig. 1.1.**

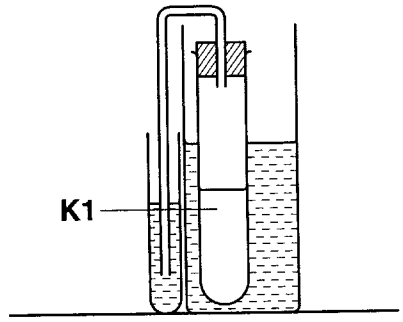

Fig. 1.1

Soon after you have set up the apparatus, bubbles of gas will emerge from the ends of at least one of the delivery tubes. After a few minutes when the bubbles appear regularly from **K1** count the number of bubbles produced in **four successive one-minute time intervals** from tubes **K1**, **K2** and **K3**. When you make a count begin timing as soon as a bubble leaves the delivery tube.

(a) Record your results in the table provided.

	bubble rate / bubbles per min		
reading	**K1**	**K2**	**K3**
1			
2			
3			
4			

Put the apparatus to one side for future reference while you answer the following questions.

(b) **(i)** State the probable nature of the bubbles of gas that are produced in **K1**.

.....

(ii) State briefly how you would modify the arrangement shown in **Fig. 1.1** to test your answer in **(b)(i).**

.....

.....

(c) Explain as fully as possible the results that you have obtained for **K1** and **K2**. Ignore any colour changes at this stage.

.....

.....

.....

.....

.....

.....

(d) State ways in which you could improve and extend the procedure in **(a)**, including the processing and analysing of the data, to allow a more accurate comparison of the **rate** of bubbling in **K1** and **K2**.

.....

.....

.....

.....

.....

.....

.....

.....

.....

(e) State a possible reason for the differences in bubbling rate that you observed in **K2** and **K3**.

.....

.....

.....

.....

Return to the **four** tubes that you put to one side.

(f) **(i)** Record your observations on any feature that is **common** to the contents of the **four** tubes.

.....

.....

(ii) Explain fully the observation that you made in **(f)(i)**.

.....

.....

.....

.....

.....

.....

(iii) What deductions can you make from the fact that your observation was common to all **four** tubes?

.....

.....

.....

.....

.....

.....

[Total: 25]

Question 2 [40 minutes]

Starch grains are found in many plant cells.
K5 is a stained transverse section of a root of a flowering plant.
Examine **K5** carefully using your microscope.
Fig. 2.1 is a diagram of a similar section.

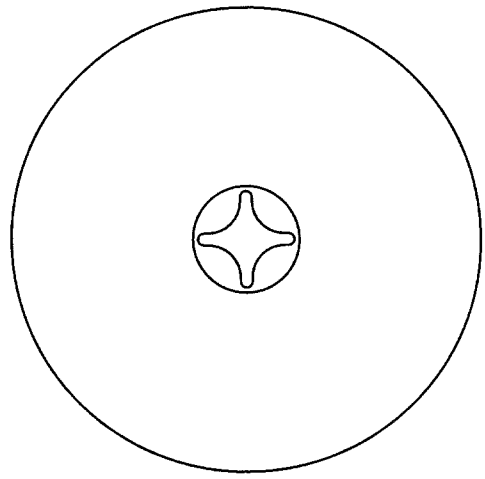

Fig. 2.1

(a) (i) Indicate by drawing a bracket **on Fig. 2.1** the region of the root that contains starch grains.

(ii) Make a drawing to show the detailed structure of **two** adjacent cells in the section that contain large numbers of starch grains. Labels are **not** required.

(iii) Explain the origin of the starch in the root of this plant.

.....

.....

Starch grains are made up of two carbohydrate components, amylose and amylopectin. Iodine solution stains amylose blue-black and amylopectin red-brown.

Starch synthesis in maize is controlled by two alleles. One allele (**a**) codes for the production of amylopectin only, the other allele (**A**) codes for both amylose and amylopectin.

You have been provided with two or three maize anthers.

Carefully place this on a clean dry microscope slide.

Tease it apart to release the fine yellow pollen grains.

Place a drop of iodine solution on the pollen grains and extend it into a 'sausage'-shape.

Wait for a minute or so then examine the slide on a white background using a hand lens and the low power of your microscope.

Count enough of the pollen grains to determine the relative numbers of blue-black and red-brown grains.

Ignore any grains that are very pale yellow in colour. Regard as blue-black any grains that show **any** evidence of blue-black staining. It is sometimes easier to detect the blue-black staining under low power with reduced illumination.

(b) **(i)** Record your observations

Number of blue-black pollen grains .....

Number of red-brown pollen grains .....

(ii) State the probable genotype of the plant that produced this pollen.

.....

(iii) Explain why pollen grains of two types are present.

.....

.....

.....

.....

(iv) In what ratio would you have **expected** the two types of grains to have occurred?

.....

(v) Carry out a chi-squared test on your data to determine if your results agree with the ratio that you stated in **(b)(iv)**.

The formula for χ^2 is as follows.

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

where O = Observed results
E = Expected results.

Distribution of χ^2

degrees of freedom (N)	probability (P)										
	0.99	0.98	0.95	0.90	0.75	0.50	0.25	0.10	0.05	0.02	0.01
1	0.00	0.00	0.00	0.02	0.10	0.45	1.32	2.71	3.84	5.41	6.64
2	0.02	0.04	0.10	0.21	0.58	1.39	2.77	4.61	5.99	7.82	9.21
3	0.12	0.19	0.35	0.58	1.21	2.37	4.11	6.25	7.82	9.84	11.34

Show your calculation in the space below.

[Total: 19]