OCR
RECOGNISING ACHIEVEMENT

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**Advanced GCE**

# BIOLOGY 2806/03/TEST

Practical Examination 2 (Part B – Practical Test)

Tuesday **23 MAY 2006** 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 8 printed pages, 3 blank pages and a Report Form.**

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Answer **all** the questions.

**Question 1** [55 minutes]

**You are required to determine the concentration of urea in a fluid resembling urine.**

The concentration of urea in urine can be determined by adding the enzyme urease which catalyses the hydrolysis of urea. The product of this reaction is ammonium carbonate.

$$\text{urea} + \text{water} \longrightarrow \text{ammonium carbonate}$$

The greater the concentration of urea (substrate) in a sample, the faster the rate of this reaction. Ammonium carbonate is alkaline. You will measure the time taken for the pH to rise by using universal indicator. Adding a weak acid will make conditions acidic at the start.

You are provided with a 0.1% solution of urea, a solution of a weak acid and universal indicator.

*Proceed as follows:*

**1** Using a 10 $cm^3$ syringe, add 10 $cm^3$ of distilled water to the boiling tube labelled **C**. Using the dropping pipette, add **five** drops of universal indicator to the water. The colour should be pale yellow or yellow/green indicating a pH of about 6.5 to 7.0.

**2** You are provided with five boiling tubes labelled **1** to **5**. Using the distilled water, the 0.1% urea solution and the 10 $cm^3$ syringes, make up five different urea concentrations, as shown in the table below.

| tube | volume of distilled water / $cm^3$ | volume of 0.1% urea / $cm^3$ | final concentration of urea / % |
|---|---|---|---|
| 1 | 0 | 10 | 0.10 |
| 2 | 2 | 8 | 0.08 |
| 3 | 4 | 6 | 0.06 |
| 4 | 6 | 4 | 0.04 |
| 5 | 8 | 2 | 0.02 |

*Read steps **3** to **7** and prepare to record your results in a suitable form in the space provided on page 4.*

**3** Using a 1 $cm^3$ syringe, add 0.5 $cm^3$ of 0.1 mol $dm^{-3}$ ethanoic acid to tube **1**. Add **five** drops of universal indicator. The contents of the tube should be pink.

**4** Using a clean 1 $cm^3$ syringe, add 1 $cm^3$ of urease solution to tube **1**. Shake the tube to mix the contents and start a stop clock or stopwatch.

**5** Record the time **t** taken for the colour of tube **1** to match the colour of tube **C**.

*Warning: beyond this end point the colour of tube **1** will continue to change to green.*

**6** Convert the time into relative rate of enzyme activity by dividing 1000 by the time taken.

**Relative rate of enzyme activity = 1000 / t** where t = time in seconds

If no colour change is recorded after ten minutes, assume that the relative rate of enzyme activity = 0.

**7** Repeat steps **3** to **6** with each of the remaining tubes.



**[Turn over**

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

**(b)** Draw a graph to illustrate your results. Use the graph paper on page 5.

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

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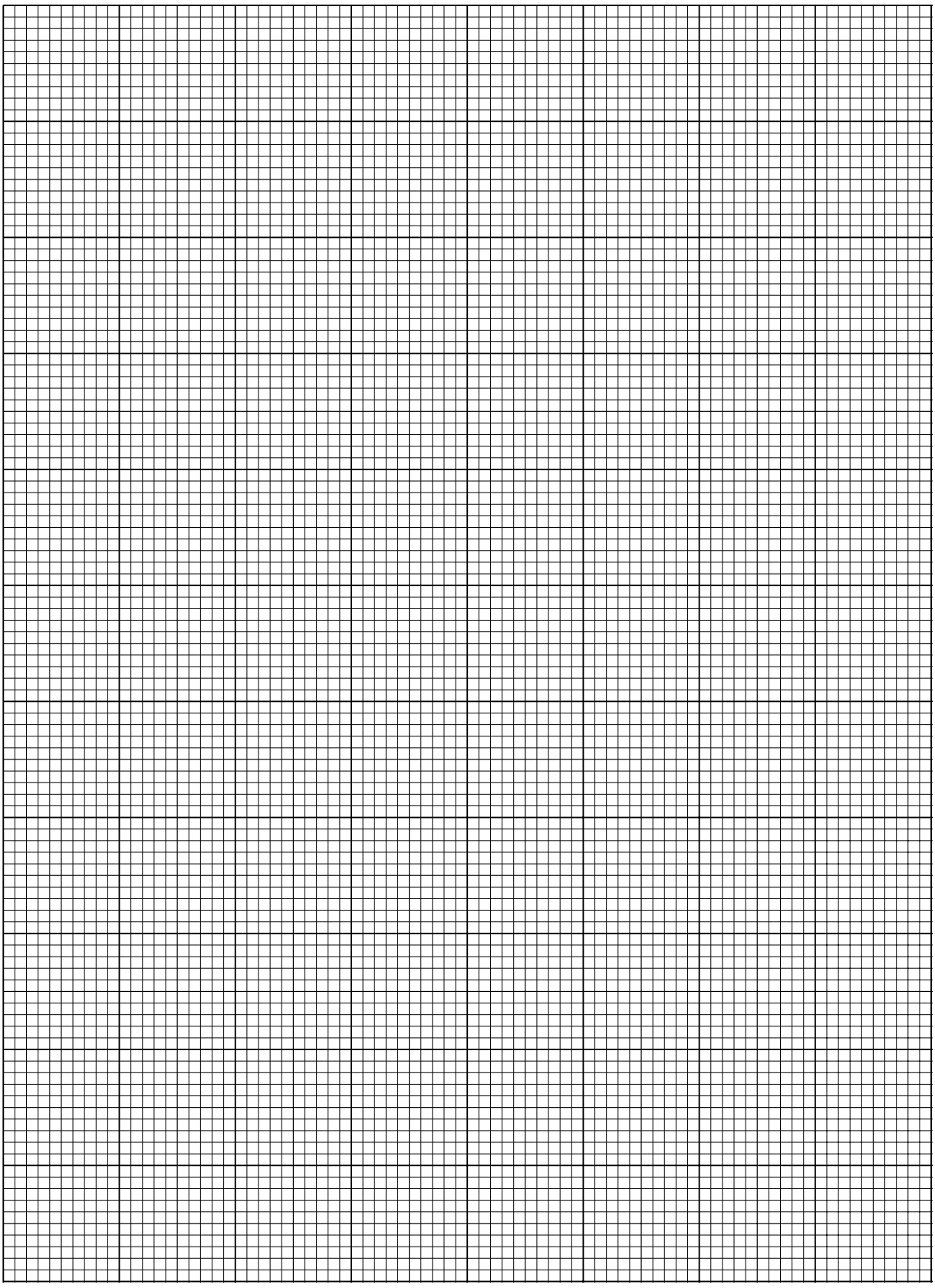
**(d)** Using the technique described on page 3, and the calibration curve you have drawn, determine the urea concentration of the 'urine' sample labelled **U**.

Record your results below and use them to determine the urea concentration of sample **U**.

Urea concentration = ..... %



**(e)** This method of determining the urea concentration of a fluid works for concentrations of urea lower than those you would normally find in urine.

The urea concentration of urine from a normal healthy individual is usually within the range 1 to 2.5 g of urea per 100 $cm^3$ of urine.

State **two** reasons why the concentration of urea in urine is sometimes higher than normal.

1 .....

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2 .....

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**(f)** The concentration of urea in sample **U** is **lower** than that normally found in the urine of a healthy individual. It is typical of someone with a medical condition known as diabetes insipidus. In this condition, antidiuretic hormone (ADH) is **not** produced.

Explain why the lack of ADH would result in a lower concentration of urea in the urine.

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**(g)** **(i)** Explain why acid was added to tubes **1** to **5** at the beginning of this investigation.

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**(ii)** The volume and concentration of acid added to each tube is critical to the activity of the enzyme urease.

Suggest why this is the case.

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**(h)** Discuss the limitations and likely sources of error in the procedure you have used to determine the urea concentration of urine. Suggest ways in which the procedure may be improved to give more accurate and reliable results.

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[Total: 28]

**Question 2** [35 minutes]

Slide **S1** is a stained section of the kidney of a mammal. Examine the slide carefully using a hand lens and the low power objective of a microscope.

**(a)** Make a **labelled low power** plan drawing to show the different regions of the kidney.

Do **not** include any cellular detail in your drawing.

**(b)** Describe features of the section that allow you to distinguish the regions you have identified.

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Slide **S2** is also a stained section of a kidney. It has been cut along a different plane.
Examine the slide carefully using a hand lens and the low power objective of your microscope.

**(c)** Show, by drawing a line on your plan drawing opposite, the plane of the cut that would have produced slide **S2**.

**(d)** Table 2.1 shows features of three tubular structures found in the kidney, namely capillaries, loops of Henlé and collecting ducts.

**Table 2.1**

| | capillaries | loops of Henlé | | collecting ducts |
|---|---|---|---|---|
| | | descending limb | ascending limb | |
| diameter / μm | 8 | 15 – 20 | 30 – 35 | 50 – 200 |
| type of cells | squamous | squamous | cuboidal | cuboidal to columnar |

Observe the central region of **S2** using the high power of your microscope. This region contains capillaries, loops of Henlé and collecting ducts.

Use Table 2.1 to help you distinguish the different structures.

Make a **high power** drawing to show the structure of a **cross section** of a **collecting duct**.

**Annotate** your drawing to describe the features you have observed and drawn.

[Total: 16]

**END OF QUESTION PAPER**

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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 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 .