OCR
RECOGNISING ACHIEVEMENT

ADVANCED GCE

2806/03/TEST

BIOLOGY

Practical Examination 2 (Part B – Practical Test)

TUESDAY 20 MAY 2008

Afternoon

Time: 1 hour 30 minutes

Candidates answer on the question paper
Additional materials (enclosed): None

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

CUP/T62954

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided.

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 **10** printed pages, **1** blank page, a Report Form and an Insert.

[Turn over

BLANK PAGE

Answer **all** the questions.

Question 1 [55 minutes]

Scientists have used a number of methods to determine the **filtration rate** of the kidneys. One method involves injecting a sucrose solution into a vein. Sucrose injected into the blood is not used by the body; it is filtered out of the blood by the kidneys. The rate at which sucrose is filtered determines the rate at which it appears in the urine.

You are provided with:

- five sucrose solutions of known concentrations in beakers labelled **A** to **E**;
- one sucrose solution of unknown concentration in a beaker labelled **F**.

Table 1.1

beaker	sucrose concentration / g 100 cm^{-3}
A	7.5
B	5.0
C	2.5
D	1.0
E	0.5
F	unknown

A healthy person took part in an investigation to find the filtration rate of their kidneys. A sample of their urine was taken 60 minutes after an injection of sucrose solution. Solution **F** contains the same concentration of sucrose as the urine sample.

You will use solutions **A** to **E** to produce a **calibration curve** from which the concentration of sucrose in solution **F** can be determined. From this result, the **filtration rate** will be determined.

Proceed as follows:

1 Set up a water bath with hot water. The water bath should not be more than one third full. Bring the water to the boil.

*Whilst waiting for the water to boil, proceed with steps **2**, **3** and **4**.*

2 Label six test-tubes, **A** to **F**.

3 Using a 5 cm^3 syringe, take 5 cm^3 of sucrose solution from beaker **F** and place it in the test-tube labelled with the same letter. Repeat this step for the remaining sucrose solutions, **A** to **E**.

4 Use a 10 cm^3 syringe to carefully add 1 cm^3 dilute hydrochloric acid to each test-tube labelled **A** to **F**. Gently shake each tube to mix the contents.

5 When the water is boiling, place all the test-tubes into the water bath and leave in the boiling water for **three** minutes. After this time, remove the tubes from the water bath using a test-tube holder and place them in the test-tube rack. Stop heating the water bath.

6 Use the second 10 cm^3 syringe to carefully add 1 cm^3 dilute sodium hydroxide solution to **each** test-tube. Mix gently using a glass rod.

7 Adjust the temperature of the water bath to 55 °C (+/– 2 °C). You may wish to use cold water to lower the temperature of the water bath.

Do not overfill the water bath.

8 Replace all the test-tubes in the water bath and maintain the temperature at 55 °C (+/– 2 °C).

Leave the tubes in the water bath for **one** minute.

9 Using the 2 cm^3 syringe, add 2 cm^3 Benedict's solution to test-tube **A** and immediately start the stopwatch or stop clock.

Observe test-tube A very carefully for the first sign of a colour change of the blue solution.
As soon as you see this, *stop the stopwatch or stop clock and note the time.*

10 Repeat step **9** for test-tubes **B** to **F**.

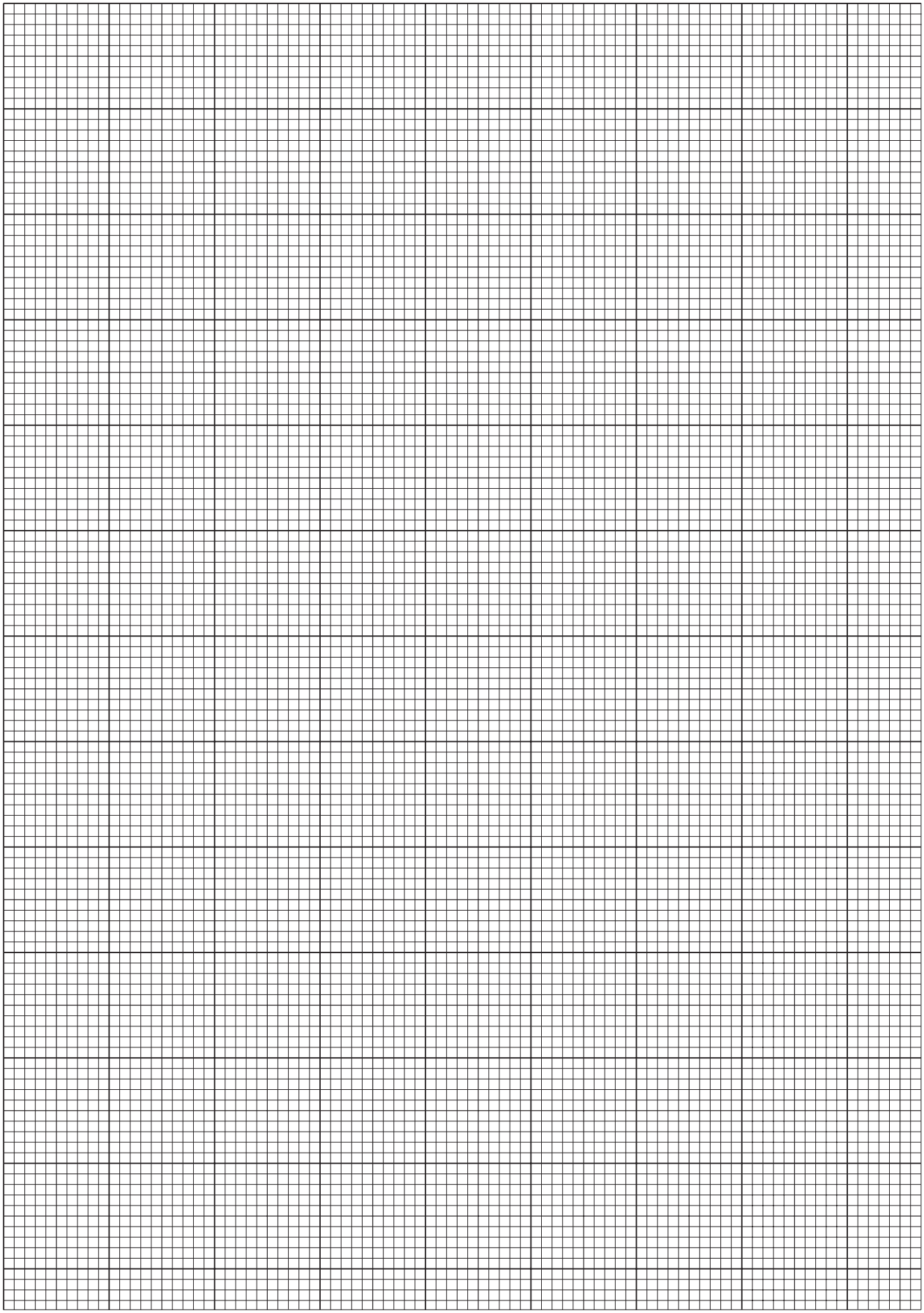
Each time, check that the temperature of the water bath is at 55 °C (+/–2 °C).

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

(b) Using the graph paper on page 5, plot a graph of your results from test-tubes **A** to **E only**.

(c) Use your graph to estimate the sucrose concentration of solution **F**.

F .....



A scientist carried out the same investigation using another healthy person, **G**.

Table 1.2 shows the volume of urine collected from person **G** 60 minutes after the injection of sucrose and the concentration of sucrose in the urine sample.

Table 1.2

	volume urine collected at 60 min / cm^3	concentration of sucrose in urine sample / g 100 cm^{-3}	concentration of sucrose in urine / mg cm^{-3}
person **G**	100	5.00	.....

(d) Calculate the concentration of sucrose in the urine of person **G** in mg cm^{-3}.

Write your answer in Table 1.2.

The volume of fluid that is filtered from the blood by the kidneys of person **G** can be calculated.

Person **G** was injected with 25 g of sucrose in 100 cm^3 water.

Samples of blood were taken after injection and the mean concentration of sucrose in the blood was found to be 0.7 mg cm^{-3}.

The filtration rate, in cm^3 min^{-1}, is calculated using the following formula:

$$\text{filtration rate} = \frac{\text{concentration of sucrose in the urine in mg cm}^{-3} \times \text{urine formation rate in cm}^3\,\text{min}^{-1}}{\text{concentration of sucrose in the blood in mg cm}^{-3}}$$

(e) Using the formula above, calculate the filtration rate, in cm^3 min^{-1}, for person **G**.

Show your working.

filtration rate = ... cm^3 min^{-1}

(f) Suggest why it is important to take into account the **volume** of urine in the calculation.

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(g) Explain why the sucrose solutions were mixed with hydrochloric acid and boiled (steps **4** and **5**).

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Evaluation exercises

(h) Discuss the **accuracy** and **reliability** of the procedure that you have followed in steps **3** to **10** to determine the sucrose concentration of solution **F**.

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(i) The method used by the **scientist** on person **G** involved injecting a sucrose solution and determining the concentration of sucrose in the urine.

Discuss the **validity** of using this method to determine the filtration rate of healthy humans.

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[Total: 28]

Question 2 [35 minutes]

Fig. 2.1 is a plan drawing of a typical vertical section through a mammalian kidney showing the main regions.

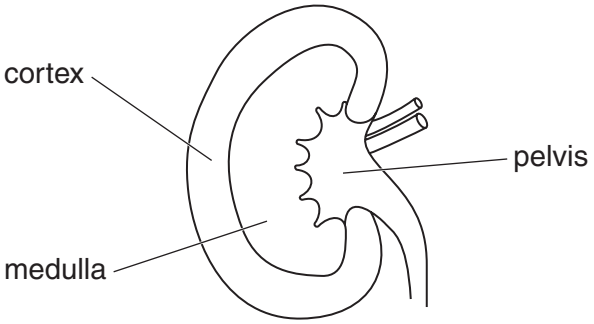


Fig. 2.1

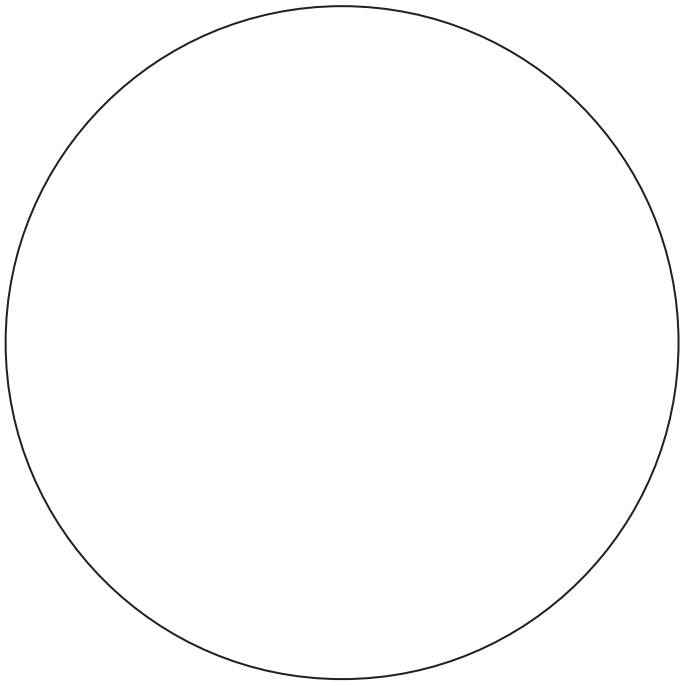
Slide **S** is a section through a mammalian kidney in the same plane as Fig. 2.1.

Renal (Bowman's) capsules are found in the **cortex**.

(a) Examine the **cortex** using the **low power** objective of your microscope.

The circle below represents the field of view of your microscope. Make a plan drawing in the circle to show the **distribution**, **shape** and **relative sizes** of the renal capsules within your field of view.

Do **not** draw individual cells or any other structures.



(b) Around the renal capsules there are convoluted tubules seen in section.

Using the **high power** objective of your microscope, draw a **transverse** section of **one** convoluted tubule.

Label your drawing.

Annotate your drawing to describe the **appearance** of the convoluted tubule as seen under your microscope.

(c) Use the **low power** objective of your microscope to examine the **medulla** of the kidney section.

State **two** ways in which the **structure** of the medulla differs from the structure of the cortex.

1 .....

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2 .....

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Fig. 2.2, **on the insert**, is an electron micrograph of part of a renal tubule.

(d) (i) Calculate the **maximum** diameter of the nucleus shown in Fig. 2.2.

Show your working and express your answer **to the nearest whole number**.

Answer = ...

(ii) Suggest why the cells shown in Fig. 2.2 contain **many** mitochondria.

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(e) Explain how the cells lining **collecting ducts** determine the concentration of the urine that enters the pelvis of the kidney.

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[Total: 16]

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 disability. If so, give brief details, and attach a copy of the letter giving permission.

Other cases of hardship, for example illness, should be reported directly to OCR by the Examinations Officer using the Special Consideration form.

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.