Anglo-Chinese School (Independent)

PRELIMINARY EXAMINATION
YEAR FOUR EXPRESS

CANDIDATE NAME	

CENTRE NUMBER	S	2	0	3	1	INDEX NUMBER				

BIOLOGY 6093/03

Paper 3 Practical Test **31 July 2024, Wednesday**

1 hour 50 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name and index number on all the work you hand in.
Give details of the practical shift and laboratory in the boxes provided.

Write in dark blue or black pen.
You may use a HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue, correction fluid or highlighters.

Answer **all** questions in the spaces provided on the Question Paper.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

The number of marks is given in brackets [ ] at the end of each question or part question.

Shift
Laboratory

For Examiner's Use	
1	
2	
3	
Total	/40

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1 Catalase is an enzyme found in living cells. It catalyses the breakdown of hydrogen peroxide to form water and oxygen.

You are going to investigate the effect of catalase concentration on the rate of oxygen production. You have been provided with a celery extract which contains catalase.

Read all the instructions but do not carry them out until you have drawn a table for your results in the space provided in 1(a)(ii).

If any solution comes into contact with your skin, wash off immediately under cold water. You are advised to wear gloves and eye protection throughout the investigation.

Step 1 Label five test-tubes **A**, **B**, **C**, **D** and **E**. Put the test-tubes into the test-tube rack.

Step 2 Use a measuring cylinder to transfer 10 cm^3 of celery extract into test-tube **A**.

Step 3 Use the measuring cylinder to transfer 5 cm^3 of celery extract from test-tube **A** to test-tube **B**.

Use the measuring cylinder to add 5 cm^3 of distilled water to test-tube **B**. Place a stopper in test-tube **B** and shake it to mix.

Step 4 Remove the stopper. Use the measuring cylinder to transfer 5 cm^3 of the liquid in test-tube **B** to test-tube **C**.

Use the measuring cylinder to add 5 cm^3 of distilled water to test-tube **C**. Place a stopper in test-tube **C** and shake it to mix.

Step 5 Remove the stopper. Use the measuring cylinder to transfer 5 cm^3 of the liquid in test-tube **C** to test-tube **D**.

Use the measuring cylinder to add 5 cm^3 of distilled water to test-tube **D**. Place a stopper in test-tube **D** and shake it to mix.

Step 6 Remove the stopper. Use the measuring cylinder to transfer 5 cm^3 of the liquid in test-tube **D** to test-tube **E**.

Use the measuring cylinder to add 5 cm^3 of distilled water to test-tube **E**. Place a stopper in test-tube **E** and shake it to mix. Remove the stopper.

(a)(i) Table 1.1 shows concentration of the celery extract in test-tubes **A** to **E**.

Table 1.1

test-tube	percentage concentration of celery extract / %
A	100.00
B	50.00
C	
D	12.50
E	6.25

Complete Table 1.1 by calculating and writing in the percentage concentration of celery extract in test-tube **C**. [1]

Step 7 Use the ruler to measure 2 cm from the top (open end) of the long test-tube. Mark this distance by drawing a line on the test-tube with the marker pen.

Step 8 Pour approximately 2 cm^3 of the celery extract from test-tube **A** into the small plastic container, as shown in Fig. 1.1.

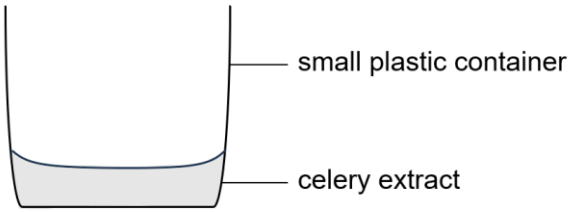

Fig. 1.1

Step 9 Use the forceps to place one paper disc into the celery extract in the small plastic container. Leave it to be immersed for about 20 seconds.

Step 10 Use the forceps to remove the paper disc from the small plastic container. Place the paper disc into the long test-tube you prepared in step 7 and push it to the bottom of the test-tube with the glass rod.

Step 11 Carefully pour hydrogen peroxide solution into the long test-tube until it reaches the line you marked on the test-tube in step 7. Immediately start the stopwatch and observe the paper disc rising.

Record the time taken, in seconds, for the paper disc to reach the surface of the hydrogen peroxide solution, in your table in **1(a)(ii)**.

If the paper disc has **not** reached the surface of the hydrogen peroxide solution after three minutes, stop the stopwatch and record the time as >180 in your table.

Step 12 Pour the hydrogen peroxide solution and paper disc into the beaker labelled 'waste'.

Step 13 Use the forceps to place another paper disc into the celery extract in the small plastic container. Leave it to be immersed for about 20 seconds.

Step 14 Use the forceps to remove the paper disc from the small plastic container. Place this paper disc into the long test-tube and push it to the bottom of the test-tube with the glass rod.

Step 15 Pour hydrogen peroxide solution into the long test-tube until it reaches the line you marked. Immediately start the stopwatch and record the time taken for the second paper disc to reach the surface of the hydrogen peroxide solution.

Step 16 Calculate the mean time taken, to the nearest whole number, for the paper discs to reach the surface and include the answer in your table in **1(a)(ii)**.

Step 17 Empty the contents of the small plastic container into the 'waste' beaker. Rinse the small plastic container and wipe it dry with a paper towel. Rinse the long test-tube and shake it dry.

Step 18 Do steps 8 to 16 for the remaining concentrations of celery extract in test-tubes **B**, **C**, **D** and **E**.

(ii) Present all your results in an appropriate table in the space provided below.

[4]

(b)(i) Identify the independent variable and the dependent variable in this investigation.

independent variable ……

dependent variable ……
[1]

(ii) State a conclusion for this investigation.

……

……

……[1]

(iii) Suggest a suitable control for this investigation **and** explain why this control would be used.

control ……

……

explanation ……

……

……[2]

(c)(i) The oxygen gas produced by the reaction forms bubbles on the paper disc which cause the disc to rise to the top of the hydrogen peroxide solution. The time taken for the disc to rise can be used to calculate the rate of the reaction.

Explain how you could calculate the rate at which the disc rises.

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……[2]

(ii) State one significant source of error in this investigation and its effect on the results.

source of error ……

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effect on results ……

……[2]

(d) Sodium chloride affects the activity of the enzyme catalase.

Plan an experiment to investigate the effect of sodium chloride concentration on the activity of catalase in celery.

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……[5]

[Total: 18]

2 Bacteria can be grown on agar jelly in a Petri dish. When they grow and multiply, the clear agar jelly becomes cloudy.

Antibiotics can prevent the growth of bacteria. Discs of filter paper dipped in an antibiotic solution can be placed on the surface of the agar. If the area around a disc remains clear, the antibiotic has prevented the growth of the bacteria. The larger the clear area, the more effective the antibiotic is.

A student investigated the effect of distilled water (**P**) and four different antibiotics (**Q**, **R**, **S** and **T**) on some bacteria using the method described.

He set up three identical Petri dishes and measured the diameter of the clear areas around the filter paper discs after a few days.

There was no clear area around disc **P** in all the three Petri dishes.

Fig. 2.1 shows the results for Petri dish 3.

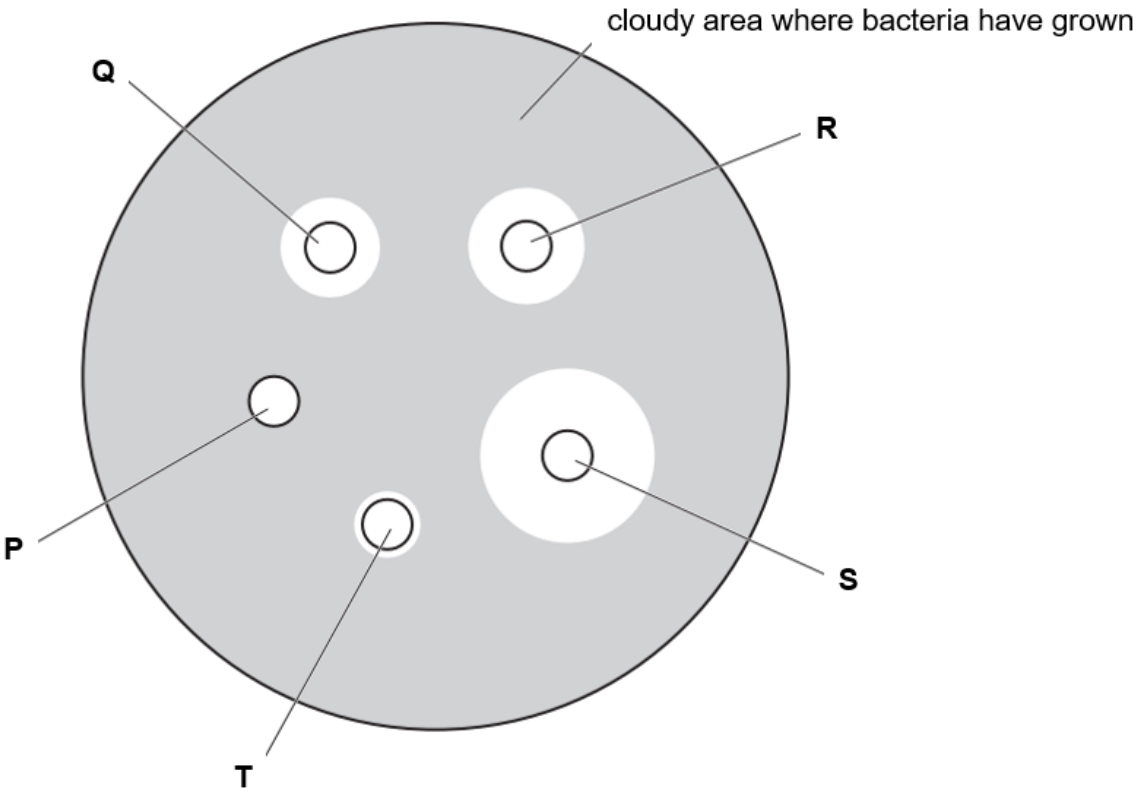


Fig. 2.1

Most of the measurements for the clear areas around the discs with antibiotics **Q**, **R**, **S** and **T** are shown in Table 2.1.

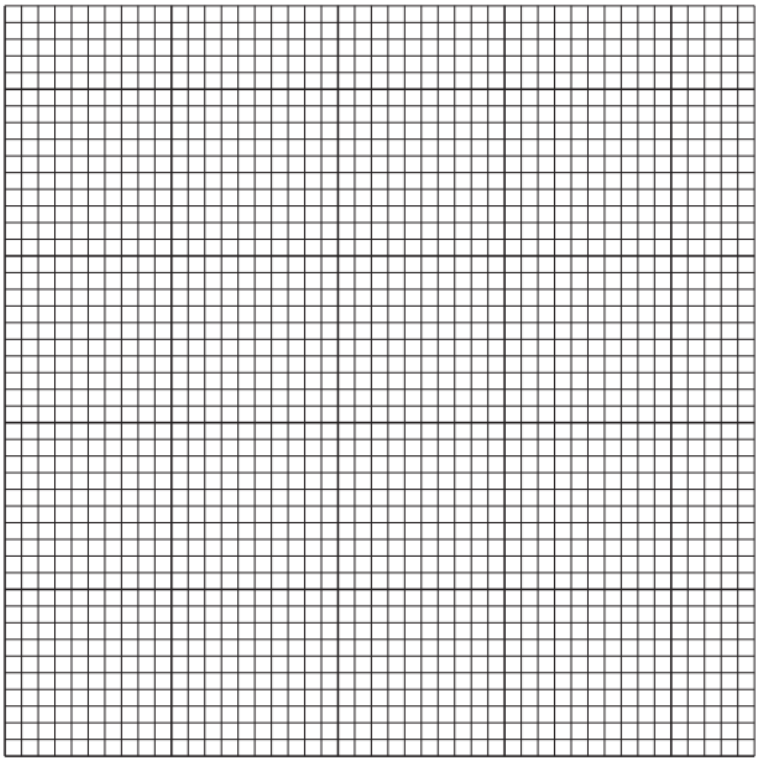
Table 2.1

antibiotic	diameter of clear area /mm			
	petri dish 1	petri dish 2	petri dish 3	mean
Q	12	6	12	10.0
R	15	14	14	14.3
S	20	21		
T	8	8	8	8.0

(a)(i) Measure the diameter of the clear area around the disc with antibiotic **S** in Fig. 2.1 and record this in Table 2.1. [1]

(ii) Calculate the mean diameter of the clear areas around the discs with antibiotic **S** and record this in Table 2.1. [1]

(b)(i) Plot a bar chart of the four mean diameters of the clear areas around the discs with antibiotics **Q**, **R**, **S** and **T.**



[4]

(ii) State which antibiotic was most effective at preventing growth of the bacteria.

……[1]

(c) The student realised that one of his results was inconsistent.

State which measurement was an inconsistent result and suggest what the student could have done about it.

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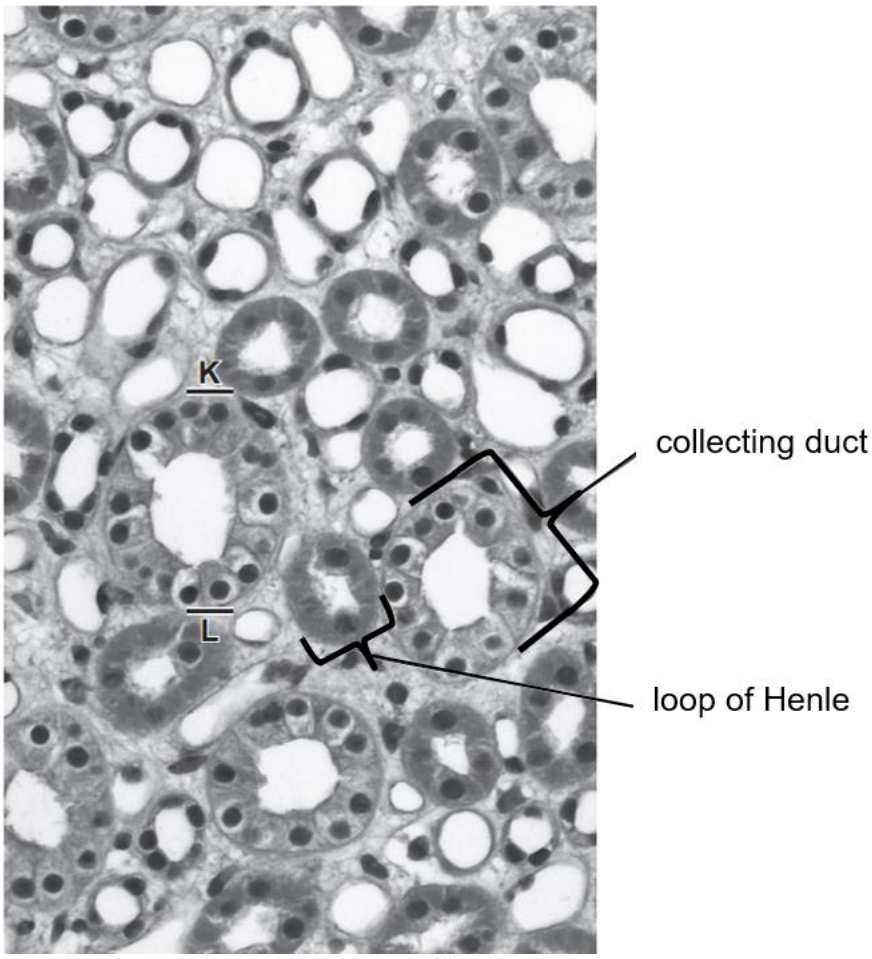
……[2]

[Total: 9]

3 Fig. 3.1 is a photomicrograph of a section through a kidney showing some kidney tubules.



magnification ×450

Fig. 3.1

(a) Make a line drawing of the collecting duct **and** loop of Henle that are labelled in Fig. 3.1. Draw them as they appear in the photomicrograph. You should **not** add any labels.

[4]

(b)(i) **K** and **L** indicate the diameter of a collecting duct.
Draw a straight line to join **K** and **L** on the collecting duct in the photomicrograph.

Measure the length of the line.

length of the line **KL** ……..…mm [1]

(ii) Calculate the actual diameter of the collecting duct using your measurement and the formula.

$$\text{magnification} = \frac{\text{length of line } \mathbf{KL}}{\text{actual diameter of the collecting duct}}$$

Give your answer to **two** significant figures.
Show your working.

actual diameter of the collecting duct …….mm [2]

(iii) The length of **KL** may not be the most accurate measurement.

Suggest how you could determine a more accurate measurement of the diameter of the **same** collecting duct in Fig. 3.1.

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…….[2]

(c) Fig. 3.2 shows a proximal convoluted tubule cell.

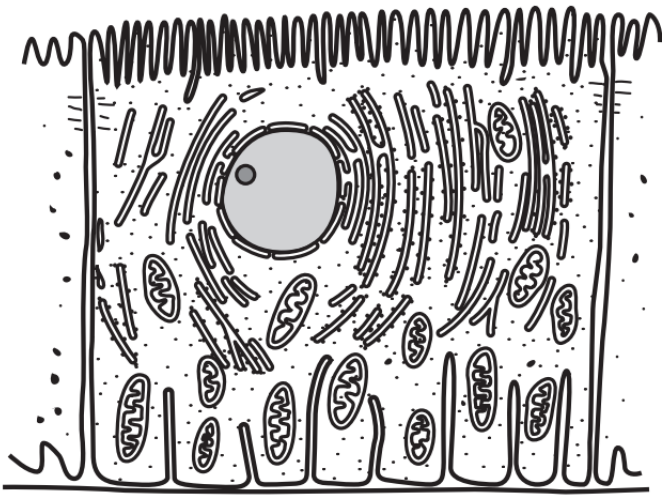

Fig. 3.2

With reference to Fig. 3.2, explain how **two** structural features of the proximal convoluted tubule cell are adaptations for its function.

1 ……..

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2 ……..

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……[4]

[Total: 13]

End of Paper