Name: Register Number: Class:

南侨中学

NAN CHIAU HIGH SCHOOL

PRELIMINARY EXAMINATION 2024
SECONDARY FOUR EXPRESS

BIOLOGY **6093/03**

Paper 3 Practical **13 Aug 2024, Tuesday**

Students answer on the Question Paper. **1 hour 50 minutes**

Additional Materials: As listed in the Confidential Instructions

READ THESE INSTRUCTIONS FIRST

Write your name, register number and class on all the work you hand in.
Give details of the practical shift and laboratory where appropriate, in the boxes provided.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.

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.

Shift
Laboratory

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

This paper consists of **10** printed pages including the cover page.

1 You are going to measure the distance moved by different concentrations of citric acid through agar.

You are provided with a Petri dish labelled **agar plate**.

The agar in the Petri dish contains Universal Indicator which will change colour in the presence of acid.

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)(iii).

You should use the safety equipment provided while you are carrying out the practical work.

Step 1 Label three test-tubes **A**, **B** and **C** and place them in a test-tube rack.

Step 2 Make three solutions, each containing a different concentration of citric acid, in the labelled test-tubes. Use the volumes of 5% citric acid and distilled water shown in Table 1.1 to make the solutions.

Table 1.1

	test tube		
	A	**B**	**C**
volume of 5% citric acid / cm^3	1.0	2.0	10.0
volume of deionised water / cm^3	9.0	8.0	0.0
percentage concentration of citric acid solution	0.5	1.0	5.0

Step 3 Turn the Petri dish over so the base side is up. Use a marker pen to draw three lines to divide the base into approximately equal sections. Label the sections **A**, **B** and **C** as shown in Fig. 1.1.

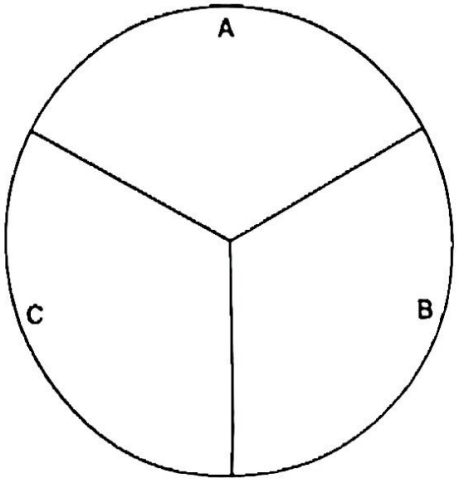


Fig. 1.1

Step 4 Turn the Petri dish so the base side is down. Use a straw to cut a hole in the centre of each section of the agar in the Petri dish, as shown in Fig. 1.2.

Hold the straw vertically and push through the agar to the bottom of the layer. As you remove the straw, twist it slightly to pull out the agar. Squeeze the end of the straw gently to push the agar you have removed onto a paper towel.

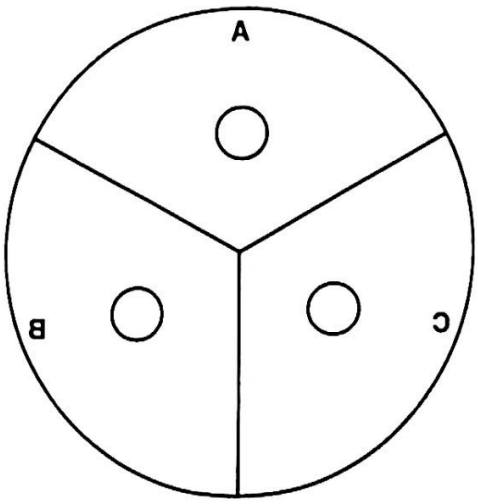


Fig. 1.2

Step 5 Use a pipette to transfer three drops of solution from test-tube **A** into the hole in the agar in section **A** of the Petri dish.

Do not let the solution drip onto the surface of the agar.

Step 6 Use a clean pipette to repeat step 5 for the solution in test-tube **B** and the hole in the agar in section **B** of the Petri dish.

Step 7 Use a clean pipette to repeat step 5 for the solution in test-tube **C** and the hole in the agar in section **C** of the Petri dish.

Step 8 Start the stopwatch and leave the Petri dish for five minutes.

Step 9 After five minutes observe the appearance of the agar around each of the holes.

(a) **(i)** Describe the appearance of the agar around the holes in **A**, **B** and **C** after five minutes.

.....

..... [1]

Step 10 Leave the Petri dish for a further 25 minutes.
During this time, continue with the other questions.

Step 11 After a total of 30 minutes use the ruler to measure the distance the citric acid has travelled from the edge of the hole in section **A**. You may need to use the hand lens.

Record your results in the table you have prepared in **1(a)(iii)**.

Step 12 Repeat step 11 for the holes in section **B** and section **C** of the Petri dish.

(ii) Describe how you decided where to measure the distance travelled by the citric acid solution.

.....

.....

..... [1]

(iii) Prepare a table to record your results.

You should include:
- the concentration of the citric acid solutions
- the distance moved by each solution in the agar.

Record your results in the table as you carry out your practical work.

[4]

(iv) State a conclusion for your results.

.....

.....

..... [1]

(v) The citric acid moves through the agar by diffusion. The diffusion coefficient is used to show the effect of concentration on diffusion.
The formula to calculate the diffusion coefficient is:

$$\text{diffusion coefficient} = \frac{(\text{distance travelled})^2}{\text{time}}$$

Calculate the diffusion coefficient for a 10% solution of citric acid that travelled 14 mm in 30 minutes.

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

Space for working.

..... mm^2 per minute [2]

(b) (i) State **two** variables that have been kept constant in this investigation

1 .....

2 ..... [2]

(ii) Identify **one** source of error in this investigation and explain how the error could affect the results.

error .....

.....

effect on results .....

.....

..... [2]

(c) Describe how you could adapt this method to find the effect of temperature on the rate of diffusion. Agar melts at 70 °C.

[6]

[Total: 19 marks]

2 (a) A student used an aquatic plant to investigate the effect of temperature on the rate of photosynthesis.

Fig. 2.1 shows the apparatus used by the student.

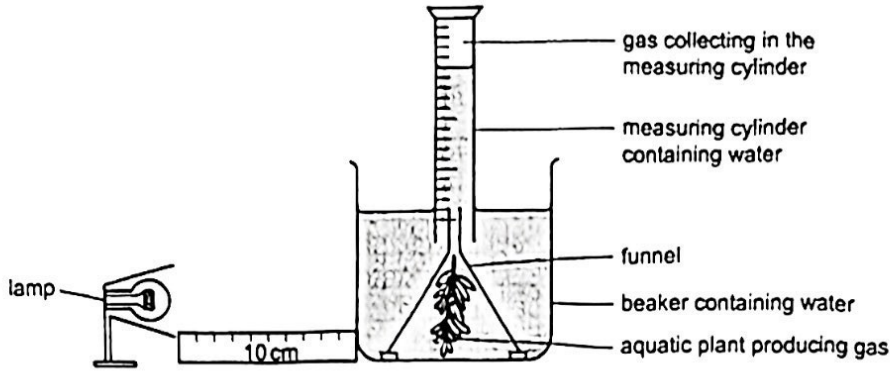


Fig. 2.1

A lamp was placed at a distance of 10 cm from the apparatus. Sodium hydrogencarbonate was added to the water to provide a source of carbon dioxide.

The student measured the volume of gas produced in 20 minutes at six different temperatures.

(i) State the independent variable in this investigation.

.....[1]

(ii) Only one set of results was collected in the investigation described in 2(a).

Explain why repeating the investigation two more times would be an improvement to the method.

.....

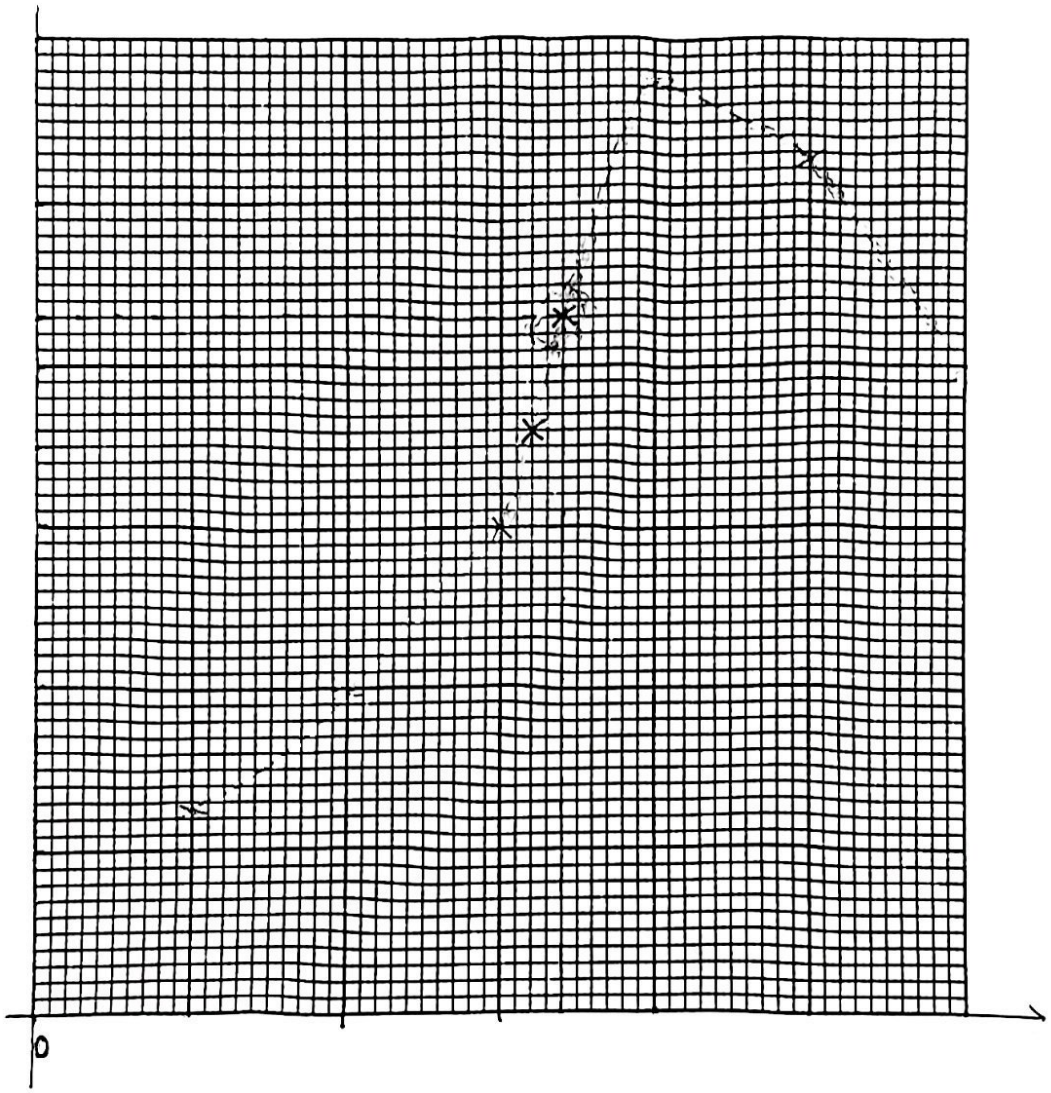
.....[1]

(b) The results of the investigation are shown in Table 2.1.

Table 2.1

temperature / °C	volume of gas collected in 20 minutes / cm^3	rate of photosynthesis / cm^3 per minute
5	5.0	0.25
10	7.8	0.39
15	12.0	0.60
20	22.8	1.14
25	21.0	1.05
30	16.0	0.80

(i) Use the information in Table 2.1 to plot a line graph on the grid to show the effect of temperature on the rate of photosynthesis



[4]

(ii) Describe the pattern shown by the data in your graph.

.....

.....

.....

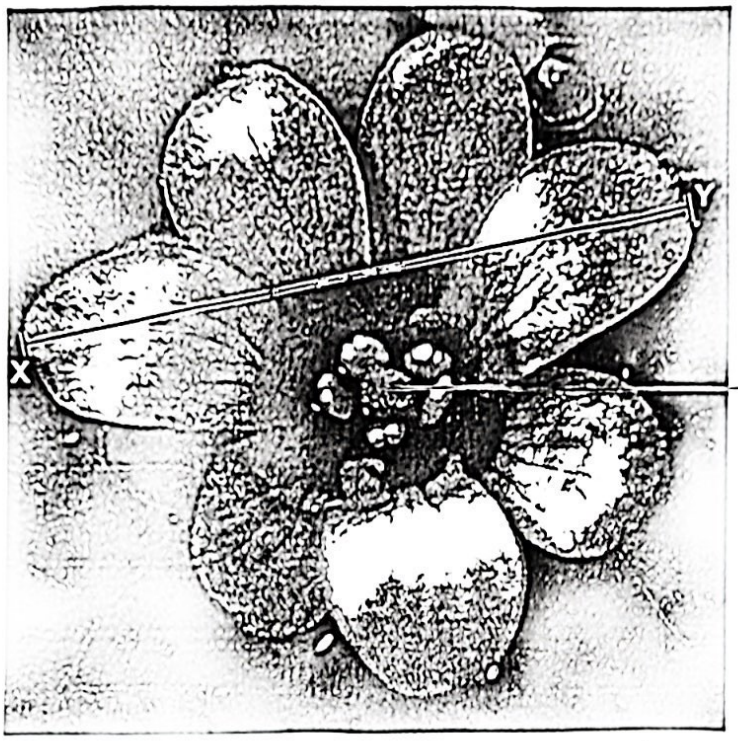
.....

..... [2]

(iii) Use your graph to estimate the rate of photosynthesis when the temperature is 17°C. Show on your graph where you took your reading.

..... cm^3 per minute [1]

(c) Fig. 2.2 is a photograph of one flower of an aquatic plant, *Cabomba caroliniana*.



magnification ×6

Fig. 2.2

(i) Make a large drawing of the flower shown in Fig. 2.2.

Label the stigma on your drawing.

[5]

(ii) Measure the length of line XY on Fig 2.2.

length of line XY ..... mm

Calculate the actual width of the flower shown in Fig. 2.2 using your measurement and the formula. Leave your answer in whole number.

$$\text{magnification} = \frac{\text{length of line XY on Fig. 2.2}}{\text{actual width of the flower}}$$

Include the unit.

Space for working.

..... [3]

The flower is bisexual. The positions of the anthers and stigma are relatively apart. Bees and wasps visit the flower frequently.

(iii) With the information provided, suggest the type of pollination this flower undergoes.

..... [1]

(iv) Suggest the advantages of this type of pollination in (iii) for the flower.

.....

.....

.....

..... [2]

(v) State the process that occurs after successful pollination.

..... [1]

[Total: 21 marks]

The End