

FUHUA SECONDARY SCHOOL Secondary Four Express PRELIMINARY EXAMINATION 2024



Fuhua Secondary School Fuhua Secondary School

## BIOLOGY

6093/02

Paper 2

Candidates answer on the Question Paper No Additional Materials are required.

DATE 22 August 2024

TIME 1115 – 1300

DURATION 1 hour 45 minutes

## READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in. Write in dark blue or black pen.

You may use an HB pencil for any diagrams, graphs or rough working. Do not use staples, paper clips, glue or correction fluid.

Section A Answer all questions. Write your answers in the spaces provided.

Section B Answer one question. Write your answers in the spaces provided.

The use of an approved scientific calculator is expected, where appropriate. The number of marks is given in brackets [] at the end of each question or part question.

FOR EXAMINER'S USE			PARENT'S SIGNATURE
Section A	Section B	Total	
/70	/10	/80	

Setter(s): Mr Joshua Tan

Vetter(s): Mr Owen Tan, Mr Nicholas Liu

This document consists of <u>18</u> printed pages, including this page.

## **Section A**

Answer all questions.

1 Pectin, a type of carbohydrate, is one of the components of cell walls which are essential to maintaining the structure of plant cells. Tomatoes are firm when unripe but soften when ripening due to the hydrolysis of these cell wall components by enzymes, including polygalacturonase. The activity of polygalacturonase can be described as follows:

polygalacturonase pectin mono-galacturonate

(a) Using the 'lock and key' hypothesis, describe the action of polygalacturonase.

[4]

The activity of polygalacturonase can be triggered by ethylene, which is released as a gas by some ripening fruits. An experiment was carried out to investigate the effect of spraying a liquid form of ethylene on the ripening of tomatoes. Table 1.1 records the concentration of ethylene used and the corresponding average number of days the tomatoes took to completely ripen.

concentration of ethylene / %	average number of days tomatoes took to completely ripen
0	20
5	16
10	13
15	11
20	10
25	10
30	10

Table 1.1

- (b) Plot a graph of the results in Table 1.1.

(c) With reference to the graph in (b), describe and explain how polygalacturonase concentration affected the number of days the tomatoes took to completely ripen.

[3]

[4]

(d) It is often advised that ripening bananas should not be placed together with other ripe fruits. Using the information provided in the question, suggest why this is so.



2 Fig. 2.1 shows the human alimentary canal.



Fig. 2.1

(a)	Name parts <b>G</b> and <b>H</b> .	
	G	
	Н	
		[2]
(b)	In which lettered part does most of the absorption of substances occur?	
		[1]

- (c) Auto-brewery syndrome (ABS) is a condition characterised by the conversion of carbohydrates into alcohol in the digestive tract by fungi or bacteria. This process, known as fermentation, can occur in anaerobic conditions. Individuals with severe ABS suffer from elevated blood alcohol levels, as well as symptoms usually associated with alcohol intoxication. Over time, these patients often experience liver failure.
  - (i) Patients with ABS are advised not to drive. Explain why.

.....[2]

(ii) Suggest how patients with ABS can manage their blood alcohol levels to reduce the likelihood of liver failure.

.....[1]

[Total: 6]

**3** Individuals with a condition known as autosomal dominant compelling helio-ophthalmic outburst (ACHOO) syndrome experience uncontrollable sneezing episodes whenever they are suddenly exposed to bright light.

Various muscles contract during sneezing, including the diaphragm muscle, abdominal muscles, and muscles at the back of the throat.

(a) Explain the nervous pathway when an individual with ACHOO syndrome is exposed to bright light and sneezes.

[5]

(b) (i) A couple, both with ACHOO syndrome decided to have a child. The child was born without ACHOO syndrome.

Use a genetic diagram to show how that is possible. Include a legend stating the letters representing each allele.



(ii) The couple decided to have another child. Calculate the probability that they will have a baby girl with ACHOO syndrome.

probability ......[2]

[Total: 11]

**4** A study investigated the probability of pregnancy resulting from sexual intercourse on specific days of the menstrual cycle.

Fig. 4.1 shows the results of this study.



Fig. 4.1

(a) (i) The study shows a probability of 20% that sexual intercourse three days before ovulation will result in pregnancy.

State how many times more likely pregnancy is if sexual intercourse takes place two days later?

......[1]

(ii) Explain the role of a named hormone in the menstrual cycle during the days investigated by this study. ..... ..... ..... ..... .....[2] (b) A woman smoked while she was pregnant. Explain how this will affect oxygen transport to the fetus. ..... ..... ......[3] Describe the transport of glucose from when it was first absorbed in a pregnant woman's (c) small intestine to when it reaches the fetus, including named organs and blood vessels. ..... ..... ..... ..... ..... ..... ..... ..... ..... ..... [5] .....

[Total: 11]

8

5 Young grass plants were grown with their roots in a mineral solution that contained nitrate ions. The plants were divided into two batches, **N** and **P**. Cyanide, which inhibits aerobic respiration, was added to the mineral solution given to the plants in batch **P**.

The mean quantity of nitrate ions in each plant was determined at regular time intervals for 70 hours. After 60 hours, the mineral solution was replaced by distilled water. The results are shown in Fig. 5.1.



Fig. 5.1

(a) Using the data in Fig. 5.1, calculate the rate of absorption of nitrate ions in batch **N** at time = 40 hours. Show your working.

rate of absorption of nitrate ions ...... mg/h [2]

(b)	Expl batcl	ain why the absorption of nitrate ions by the plants in batch ${f N}$ differs from that in ${f n}$ ${f P}.$			
		[4]			
(c)	The mean quantity of nitrate ions in both batches of plants decreased after 60 hours.				
	(i)	State the process responsible for this decrease.			
		[1]			
	(ii)	Explain how the process stated in (c)(i) resulted in the decrease.			
		[2]			
		[Total: 9]			

6 Our eyes require photoreceptors to be able to detect light. Rod cells and cone cells are two types of photoreceptors. Rod cells detect light of low intensity and provide night vision in shades of grey. Cone cells detect light of high intensity and provide colour vision, allowing us to see sharply.

The number of rod cells and cone cells at places across the retina were recorded.

The diagram of an eye in Fig. 6.1 shows the angles from the fovea where the recordings were made.

The graph in Fig. 6.1 shows the number of rod cells and cone cells across the retina.



(a)	Stat	e the part of the eye that refracts light the most.	
			[1]
(b)	(i)	Identify the parts of the eye <b>A</b> and <b>B</b> represent in Fig. 6.1 by filling in the boxes	[2]
	(ii)	Use Fig. 6.1 to describe the distribution of rod cells and cone cells across the re-	tina.
			••••
			••••
			••••
			[4]
(c)	(i)	State the type of neurone found in the optic nerve.	
			[1]
	(ii)	Explain the function of the neurone stated in <b>(c)(i)</b> .	
			••••
			[2]
		[Total:	: 10]

7 (a) Fig. 7.1. shows a pathogen.





	(i)	Identify the type of pathogen shown in Fig. 7.1.	
	(ii)	Name structure <b>D</b> .	[1]
			[1]
(b)	"Vir to th	uses are able to evolve faster than humans, hence humans will eventually succ ne ever-evolving viruses and go extinct." Discuss the validity of this statement.	umb
			[4]

(c) Viruses are unable to replicate by themselves and require a host cell for replication. Describe how the virus makes use of named human cell components to synthesise viral proteins needed for the virus' assembly.

[4] [Total: 10]

## Section B

Answer **one** question from this section.

- 8 Rice, maize and wheat plants are the main carbohydrate source for more than 60% of the human population.
  - (a) Fig. 8.1 shows the nutritional information of rice.

Nutrition Facts	
Serving Size: 150 g	
Amount Per 100 g	
Calories 121	
% Da	ily Values*
Total Fat 0.38g	1%
Saturated Fat 0.09g	0%
Polyunsaturated Fat 0.122g	
Monounsaturated Fat 0.128g	
Cholesterol Omg	0%
Sodium 126mg	5%
Potassium 32mg	
Total Carbohydrate 25.22g	8%
Dietary Fiber 0.4g	2%
Sugars 0.05g	
Protein 3.54g	

Fig. 8.1

Calculate the mass of carbohydrate in grams per serving of rice. Leave your answer to 2 decimal places.

mass of carbohydrate ..... g [1]

(b) State and describe the process plants like these carry out to produce carbohydrates using materials from the environment.

 (c) Besides carrying out the process stated in **8(b)**, discuss the roles these plants play in the carbon cycle in terms of the removal and release of carbon dioxide into the atmosphere.

[4] [Total: 10]

- **9** Globally, deforestation still outpaces reforestation, causing a net loss of five million hectares of forests every year.
  - (a) Describe the consequences of deforestation on animals that live in the forests.

 (b) Fig. 9.1 shows shorter plants called shrubs that are often found in dark and humid environments near the forest floor of tropical rainforests.



Fig. 9.1

Deforestation removes the top canopy of rainforests, exposing the shrubs. Explain how deforestation will affect the rate of transpiration in these shrubs.

[6]

[Total: 10]

18

End of Paper