

JURONGVILLE SECONDARY SCHOOL PRELIMINARY EXAMINATION 2024 Secondary 4 Express



| STUDENT NAME | | | |
|-----------------|------------|-------------|--|
| CLASS | IND NUM | EX ⁄/BER | |

BIOLOGY

Paper 2

6093/02

1 hour 45 minutes

12 August 2024

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces on all the work you hand in. Write in dark blue or black pen. You may use pencil for drawing diagrams or graphs. Do not use staples, paper clips, highlighters, 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

DO NOT OPEN THE BOOKLET UNTIL YOU ARE TOLD TO DO SO

| For Examiner's Use | | |
|--------------------|----|--|
| Section A | 70 | |
| Section B | 10 | |
| Total | 80 | |

Setter: Ms Jo-Ann Lee Hui

This document consists of **19** printed pages.

Section A: Structured Questions [50 marks]

Answer **all** questions. Write your answers in the spaces provided.

1 A substance called phenol that is found in the flesh of apples turns brown when it is exposed to air for a period of time. This browning involves an enzyme called polyphenol oxidase which catalyses the conversion of phenol found in apples to a brown compound called melanin.

A student carried out an investigation of the action of polyphenol oxidase on phenol. Four test-tubes were set up with different contents as follows:

| test tube | test tube contents |
|-----------|---|
| 1 | phenol + polyphenol oxidase solution |
| 2 | phenol + boiled polyphenol oxidase solution |
| 3 | phenol + polyphenol oxidase solution + dilute hydrochloric acid |
| 4 | phenol + polyphenol oxidase solution + aqueous sodium hydroxide |
| 5 | phenol + distilled water |

Each test-tube was shaken thoroughly and then placed in a water bath that was maintained at 40 °C. After some time, the observations for each test tubes were recorded in Table 1.1.

| Table 1.1 | |
|-----------|--|
|-----------|--|

| test tube | 1 | 2 | 3 | 4 | 5 |
|---|------------|------------|------------|------------|------------|
| colour at the start of the experiment | colourless | colourless | colourless | colourless | colourless |
| colour at the end of the experiment | | | brown | colourless | colourless |

- (a) (i) Fill in the blanks in Table 1.1 by stating the colour at the end of the experiment for testtubes 1 and 2. [2]
 - (ii) Explain your answer for (a)(i).



| (b) | State the reason for the result in test-tube 4. | |
|-----|--|---------|
| | | [1] |
| (c) | Explain the purpose of test-tube 5. | |
| | | |
| (d) | Suggest two factors that must be kept constant during the investigation. | נין |
| | | ••• |
| | | |
| | | [2] |
| | [Tota | l: 9] |

2 In an investigation, the volume of samples of 20 dried raisins was measured. Each sample was then placed in water or sugar solutions of different concentrations.

After 12 hours, the raisins were blotted dry and the volume of each sample of raisins was measured again. Fig. 2.1 shows the results.



(a) Explain why samples of 20 raisins were used rather than a sample of one raisin.

......[1]

(b) Calculate the percentage increase in the volume of the sample of raisins in 5% sugar solution.



3 Fig. 3.1 shows a human heart in which the coronary arteries are partially blocked. A coronary by-pass operation is a remedy for this. It involves grafting sections of vein from the patient's leg to the heart.





| (a) | Name A and B on the diagram. | [2] |
|-----|---|---------|
| (b) | Explain how blockages in coronary arteries affect the heart's ability to work. | |
| | | |
| | | |
| | | [2] |
| (c) | Suggest why a blockage at X will have more serious consequences than a blockage at Y | |
| | | |
| | | [1] |
| (d) | Suggest why a coronary by-pass is preferable to a heart transplant operation. | |
| | | |
| | | [1] |
| (e) | State two precautions that can be taken to reduce the risk of coronary heart disease. | |
| | | |
| | | |
| | | [2] |
| | [To | tal: 7] |

4 A seal is a mammal that spends most of its time in the sea. It breathes and respires in a similar way

to humans, but when it dives to hunt and catch fish, can stay under water for an extended length of time each dive.

Fig. 4.1 shows the percentage concentrations of oxygen, carbon dioxide and lactic acid in a seal's blood over a 40 minute period during which it dives to hunt for fish at some point.



Fig. 4.1



(d) Suggest and explain what would happen to the concentration of lactic acid in the seal's blood when it returns to the surface of the sea after its dive.

[3] [Total: 7] 5 An investigation was carried out into the effect of eating two different sources of carbohydrate on the concentration of glucose and the concentration of insulin in the blood plasma. The carbohydrate sources used were glucose and rice. The carbohydrate in rice is mainly in the form of starch.

Volunteers were fed either 50 g of glucose or the quantity of rice known to contain 50 g of carbohydrate. The concentration of glucose and insulin in their blood plasma was then measured at intervals for 3 hours. The results are shown in Fig. 5.1 and 5.2.



Fig. 5.2

5 (a) (i) Calculate the percentage difference between the maximum concentrations of glucose in the blood after eating rice and eating glucose.

Show your working in the space provided.

percentage difference: % [2]

(ii) Explain why there is a difference in the maximum concentrations of glucose in the blood after eating rice and eating glucose.

(b) With reference to Fig. 5.1 and Fig. 5.2, explain the differences between the concentrations of insulin in the blood after eating glucose and eating rice.

[3]

(c) By 180 minutes after eating the glucose or rice, the concentration of glucose in the blood had fallen considerably.

Describe the role insulin and the liver in bringing about the reduction in blood glucose concentration.

[3]

[Total: 10]

6 Table 6.1 shows the rate of photosynthesis of a plant over a range of light intensities.

| light intensity / lux | rate of photosynthesis / mg carbohydrate | |
|-----------------------|--|--|
| | produced per drift area per min | |
| 5 | 2 | |
| 10 | 5 | |
| 20 | 9 | |
| 30 | 19 | |
| 40 | 23 | |
| 50 | 32 | |
| 60 | 43 | |
| 70 | 55 | |
| 80 | 55 | |

| Table | 6.1 |
|-------|-----|
|-------|-----|

(a) State the general relationship between light intensity and the rate of photosynthesis.



7 Fig. 7.1 shows a diagram of a kidney nephron.



Fig. 7.1

(a) Describe one feature of the structure of A and explain how this feature aids in the formation of urine.

| |
|---------|
| |
| [2] |

7 (b) Fig. 7.2 shows the proportions of certain components in glomerular filtrate and urine from a healthy person.



- (i) Draw a line labelled G on Fig. 7.1 to show where the glomerular filtrate was obtained. [1]
- (ii) Use information from Fig. 7.2 to show that selective reabsorption occurs in the kidney tubule.
 [3]
 (iii) Explain how the proportion of the components in the glomerular filtrate would change after eating a diet rich in meat.
 [3]
 [3]
 [3]
 [3]
 [3]
 [3]



8 Fig. 8.1 shows the stages in the process of genetic engineering to produce the hormone insulin.



(a) State the type of cell division that takes place in stage M of Fig. 8.1. Use your knowledge of the process of cell division to explain why it is important that this type of cell division occurs.

(b) Genetic engineering can also be used to produce crop plants for humans to eat.

Discuss the potential advantages and danger of using genetic engineering to produce crop plants for humans to eat.

[4]

[Total: 7]

9 The table below shows the distribution in blood group among a population of 1000 people living in a small town.

| blood group | number of people |
|-------------|------------------|
| А | 400 |
| AB | 40 |
| В | 100 |
| 0 | 460 |

Table 9.1

(a) With reference to the data above, draw a bar graph to represent the data.



[3]

(b) Identify and explain the type of variation that is shown by blood group.

 (c) Blood groups of individuals are inherited from their family members. Fig 9.1 shows a family tree.



(i) Using a genetic diagram, determine the probability that individuals 1 and 2 can have a child with blood group AB.

probability =[4]

(ii) Deduce using Fig. 9.1 the possible blood group(s) that individual 7 could have.

......[1]

[Total: 10]

Section B (10 marks)

Answer one question.

- **10** Tuberculosis is caused by bacteria called *mycobacterium tuberculosis*.
 - (a) Describe two features of a bacterial cell that are different from an animal cell.
 - 1 2[2]
 - (b) Fig. 10.1 shows the annual hospitalisation rate for tuberculosis by age group in Singapore between 1998 and 2004.



Fig. 10.1

Using Fig. 10.1, describe the differences in the hospitalisation rate for people aged 75 and above with people aged 15 to 74.

Suggest a reason for the differences.

[3]

(c) National Childhood Immunisation Programme (NCIP) in Singapore started to cover vaccination against tuberculosis in the 1950s.

Explain the different ways in which vaccines and antibiotics are used to reduce the number of deaths by tuberculosis.

[Total: 10]

11 A team of scientists wanted to compare the efficiency of raising chickens in a farm. This farm grows maize to feed the chickens, which are kept in cages when they are not allowed to move much.

Fig. 11.1 shows a chicken mite (not drawn to scale) which is a parasite feeding on the blood of the chicken. It leads to lower weight and egg production in the chicken. There can be up to 1000 chicken mites living in some chickens.



(a) With reference to the information above, construct a food chain consisting of the organisms in the farm in the space below.

| pyramid of numbers | pyramid of biomass |
|--------------------|--------------------|
| | |
| | |
| | |
| | |
| | [2] |

(c) Explain how energy losses occur along food chains.

[3]

(d) For the past few weeks, the farm has attempted to increase its output of crops by spraying the crops with more pesticides and fertilisers.

Predict and explain what might happen to the organisms in a river located near the farm in the next few months.

[4]

[Total: 10]

End of paper