



ANGLICAN HIGH SCHOOL
SECONDARY FOUR
PRELIMINARY EXAMINATION 2025

S4

CANDIDATE
NAME

CLASS

4	
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INDEX NUMBER

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BIOLOGY
Paper 2

6093/02
1 hour 45 minutes

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

READ THESE INSTRUCTIONS FIRST

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

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

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.

This document consists of **21** printed pages.
Section A

Answer **all** questions.

- 1 Fig. 1.1 shows enzyme **1** catalysing the breakdown of molecule **A** into two smaller molecules, **B** and **C**.

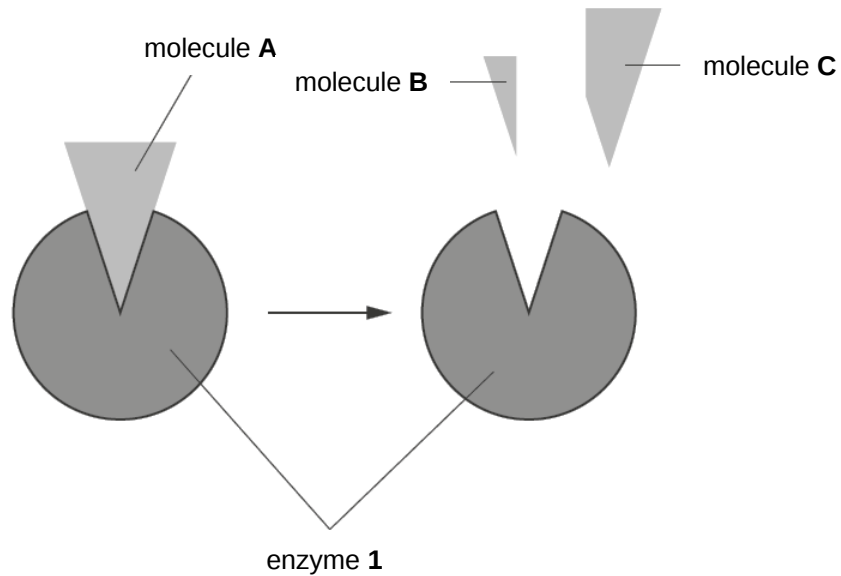


Fig. 1.1

- (a) Suggest the identity of enzyme **1** and molecule **A**.

enzyme **1**.....

molecule **A**.....

[2]

Molecule **D**, shown in Fig. 1.2, is added to the mixture shown in Fig. 1.1. This causes the rate of production of molecules **B** and **C** to decrease.

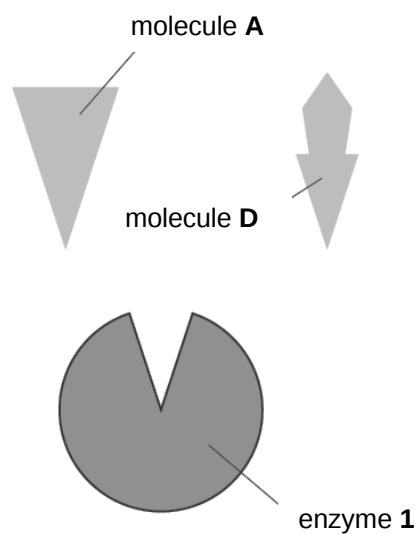


Fig. 1.2

- (b) (i) Using the information in Fig. 1.1 and Fig. 1.2, explain why the rate of production of molecules **B** and **C** decreases after molecule **D** is added.

.....

[3]

- (ii) An example of molecule **D** is cyanide which can bind to an enzyme present in the mitochondria of cells. This enzyme is involved in aerobic respiration reactions. Suggest and explain the effect of cyanide poisoning on a person.

.....

[3]

[Total:8]

- 2 (a) Fig. 2 is a diagram of a bacterial cell.

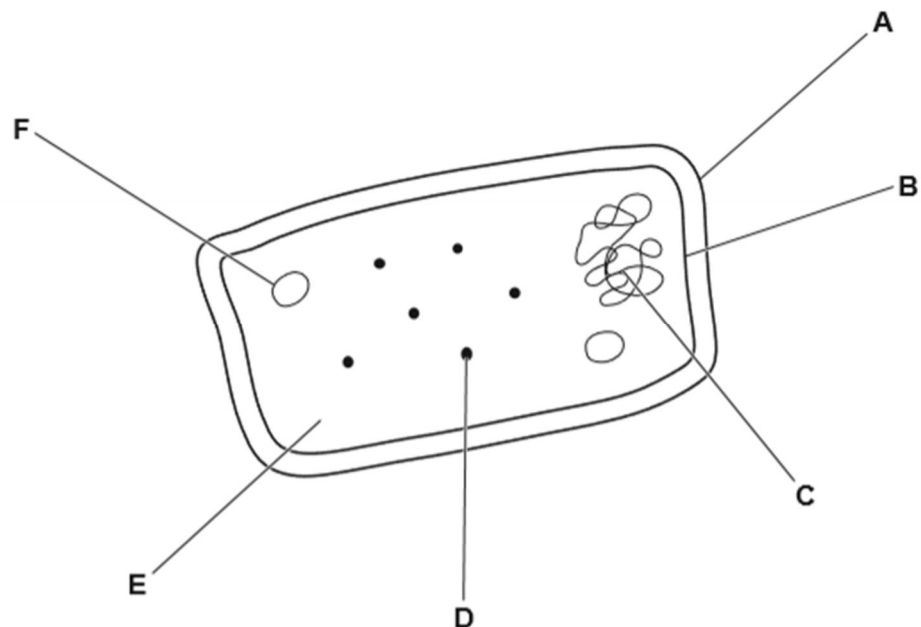


Fig. 2

- (i) Using letters **A – F**, identify two parts of the cell that contain DNA.

.....and.....

[1]

- (ii) State the function of the part labelled **D**.

.....[1]

- (iii) Food preservation includes methods used to prevent bacterial growth on food. One such method is salting, where the food is kept in bottles of concentrated salt solution.

Using appropriate **letters** in Fig. 2, explain how salting can inhibit bacterial growth on foods.

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.....[3]

- (b) Anthrax is a serious disease caused by the *Bacillus anthracis* bacteria. It was used in 2001 in the United States to attack people as a means of bioterrorism.

According to the United States Centers for Disease Control and Prevention, getting antibiotics quickly is essential to saving lives during an anthrax attack.

Describe two ways in which antibiotics work to kill the bacteria.

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.....[2]

[Total:7]

- 3 (a)** The glycaemic index (GI) is a numerical scale that ranks carbohydrate-containing foods based on how quickly they raise blood glucose concentrations after eating.

Fig. 3.1 shows the effect on the blood glucose concentration after eating high GI food and low GI food.

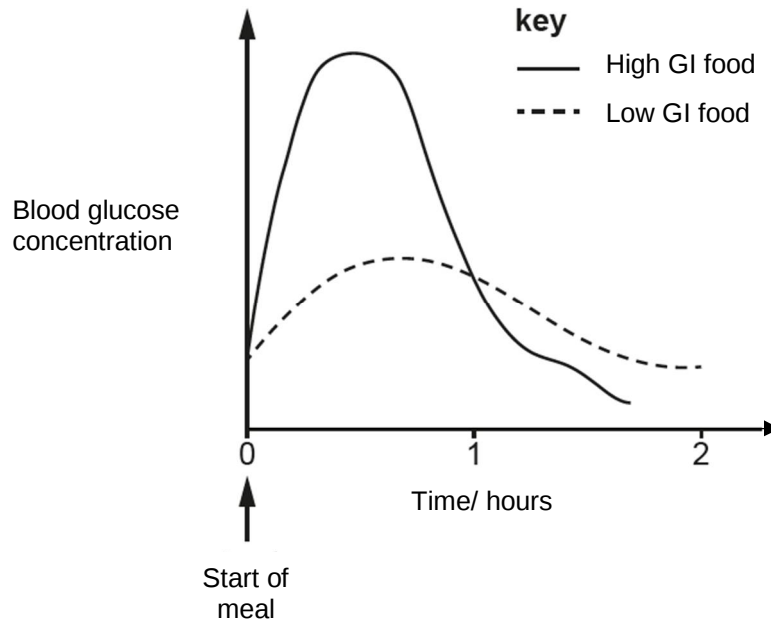


Fig. 3.1

- (i)** Starch is an example of a carbohydrate. Describe how starch is fully digested by the human digestive system.

.....

[2]

- (ii)** Suggest why consuming low GI food is better for health.

.....

[1]

- (b) Fig. 3.2 shows the blood glucose concentrations of three different people, **G**, **H** and **J**, over a 48-hour period.

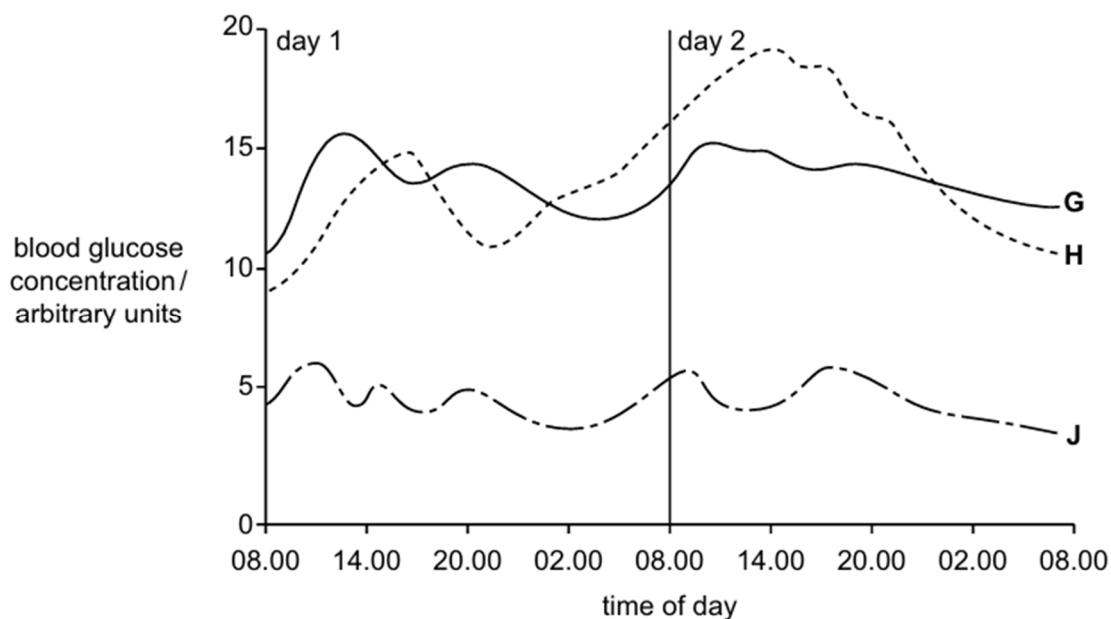


Fig. 3.2

Two of these people are diabetic. One of them produces small quantities of insulin. The other person produces no insulin.

The third person is **not** diabetic.

- (i) Using the letters **G**, **H** and **J**, arrange the three people according to decreasing quantities of insulin produced. [1]

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- (ii) Explain how the non-diabetic person regulates his blood glucose concentration after a heavy meal of carbohydrates.

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.....[5]

- (c) Diabetes is commonly treated by injection of insulin.

AFREZZA® is a form of inhaled insulin that can be administered by breathing it in.

Suggest how insulin taken by this route enters the blood.

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.....[3]

[Total:12]

- 4 (a) Fig. 4.1 shows a capillary inside the human testis.

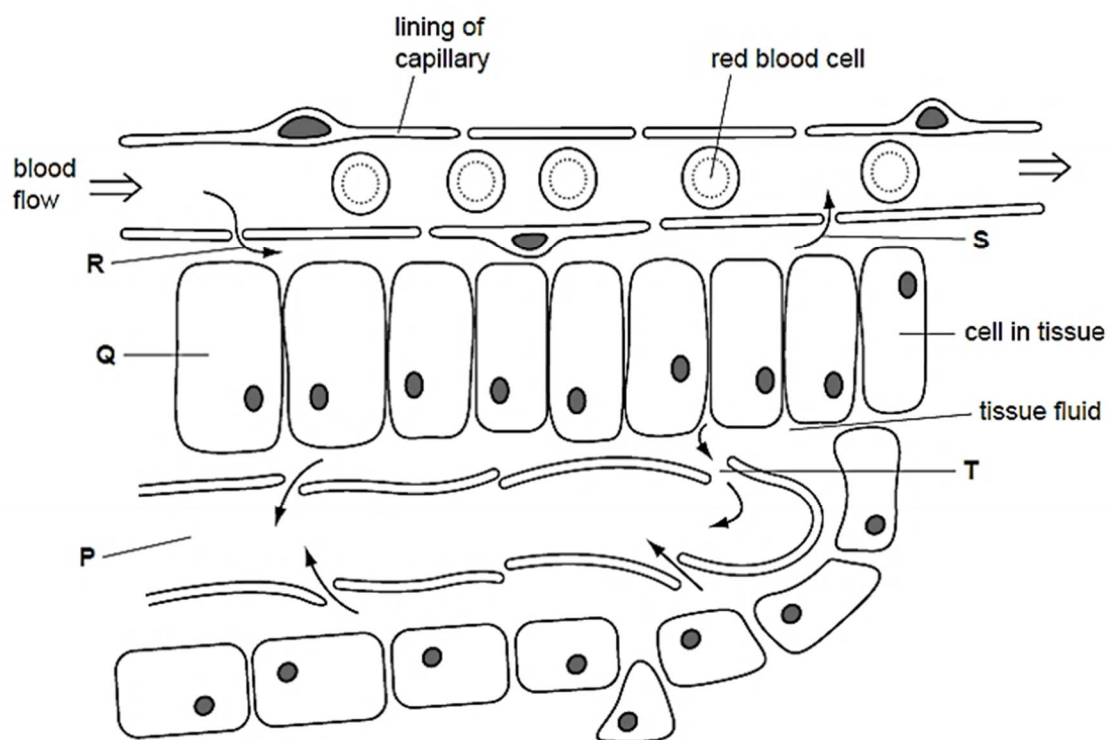


Fig. 4.1

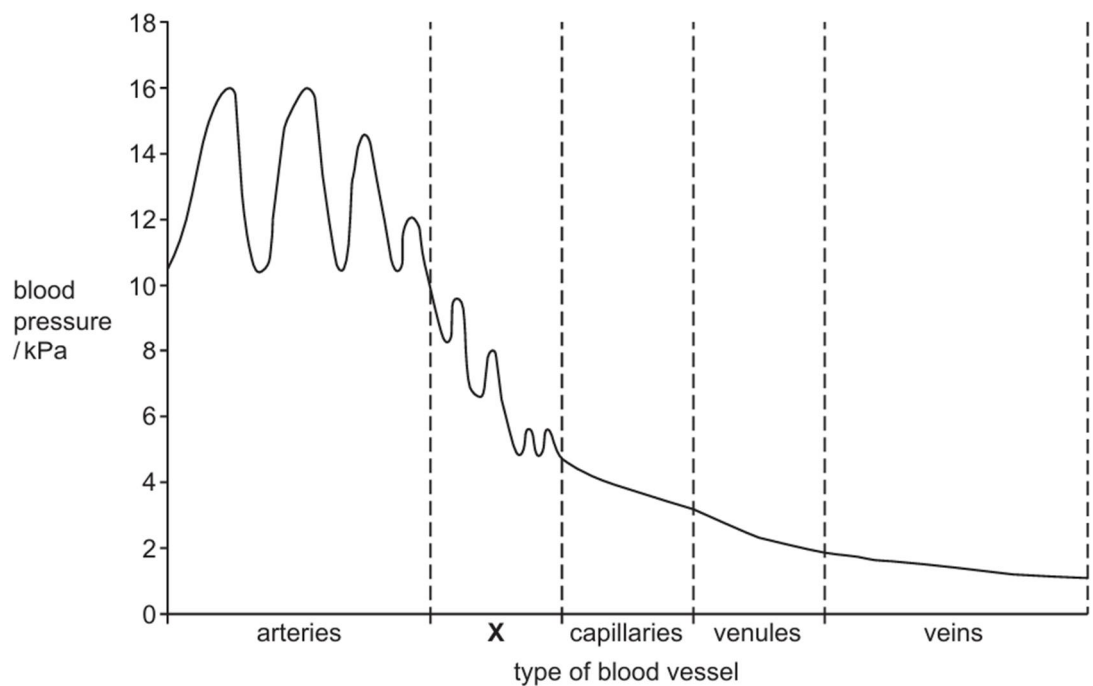
- (i) Name one substance that is transported at S.

.....[1]

- (ii) With reference to Fig. 4.1, describe and explain one way in which capillaries are adapted to their function.

.....[2]

- (b)** Fig. 4.2 shows the pressure of blood flowing through different blood vessels as it travels around the body.



- (i) Blood vessels **X** in Fig. 4.2 supply blood to skin-surface capillaries and have a role in maintaining a constant internal temperature.

State the blood vessels that are represented by the letter **X**.

.....[1]

- (ii) Explain the changes in pressure seen in the **arteries**.

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.....[2]

[Total:6]

- 5 A sneeze can be triggered by dust receptor cells in the lining of the nose or throat. During a sneeze, air is exhaled from the nose and mouth with some force and the eyelids close, as shown in Fig. 5.

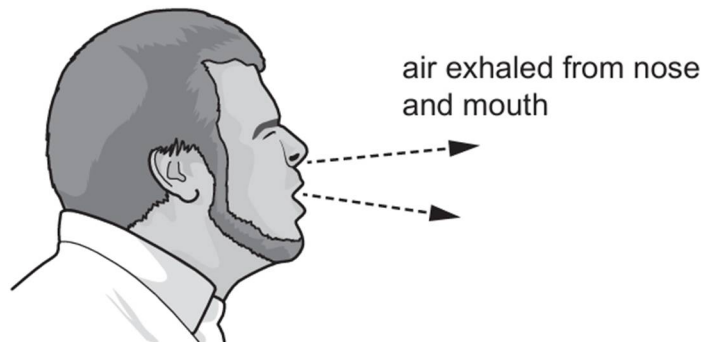


Fig. 5

Describe how the closure of the eyelids during a sneeze is coordinated.

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.....[5]

[Total:5]

6 Fig. 6 shows part of a monkey flower plant.



Fig. 6

- (a) (i) State the method of pollination and give one evidence, **visible** in Fig. 6, that supports your answer.

Method of pollination.....

Evidence.....

.....[2]

- (ii) The monkey flower plant in Fig. 6 reproduces sexually.

Describe two advantages of sexual reproduction for monkey flower plants.

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.....[2]

- (b) Monkey flower plants were introduced to Europe from North America about 200 years ago.

Scientists measured the leaf area of five monkey flower plants growing in Europe and North America.

Their results are shown in Table 6.1 and 6.2 respectively.

Table 6.1

Plants growing in Europe	
Plant number	Leaf area/ cm ²
1	310
2	335
3	390
4	348
5	365
mean	350

Table 6.2

Plants growing in North America	
Plant number	Leaf area/ cm ²
1	282
2	301
3	288
4	290
5	294
mean	291

Monthly sunshine average measures the number of hours of sunshine per day in a month. Most of temperate Europe sees considerably lower monthly sunshine averages than North America.

Using the information in Table 6.1 and 6.2, explain how the monkey flower plants in North America are adapted to survive in Europe.

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.....[2]

- (c) Ancestors of monkey flower plants were found to have a much smaller leaf area.

Explain how the monkey flower plants have developed a larger leaf area over time.

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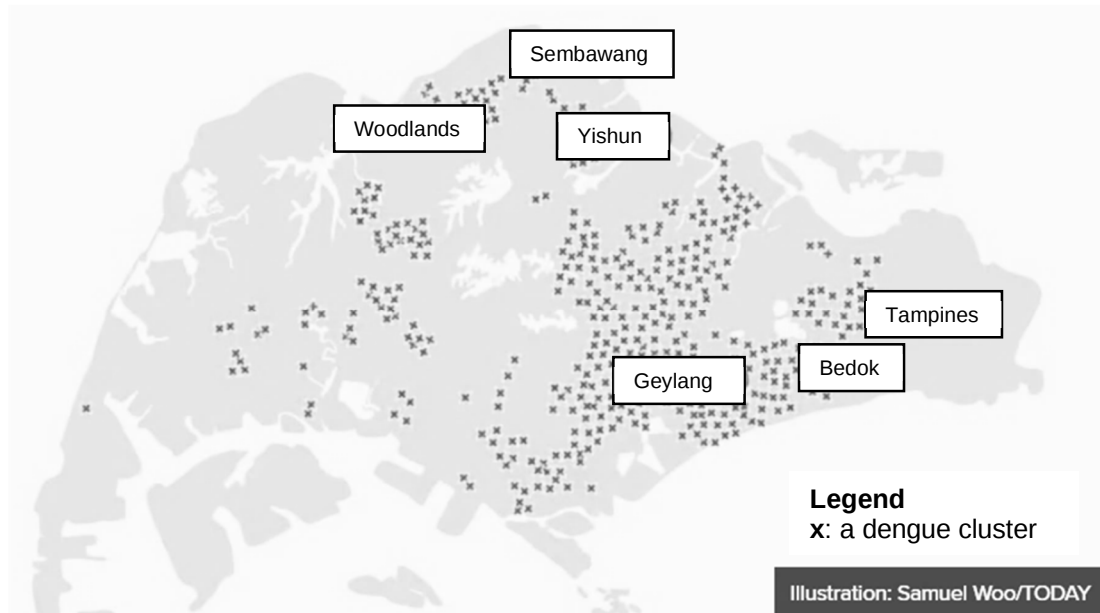
.....[4]

[Total:10]

- 7 Dengue fever is a viral disease that causes symptoms such as high fever and severe headaches.

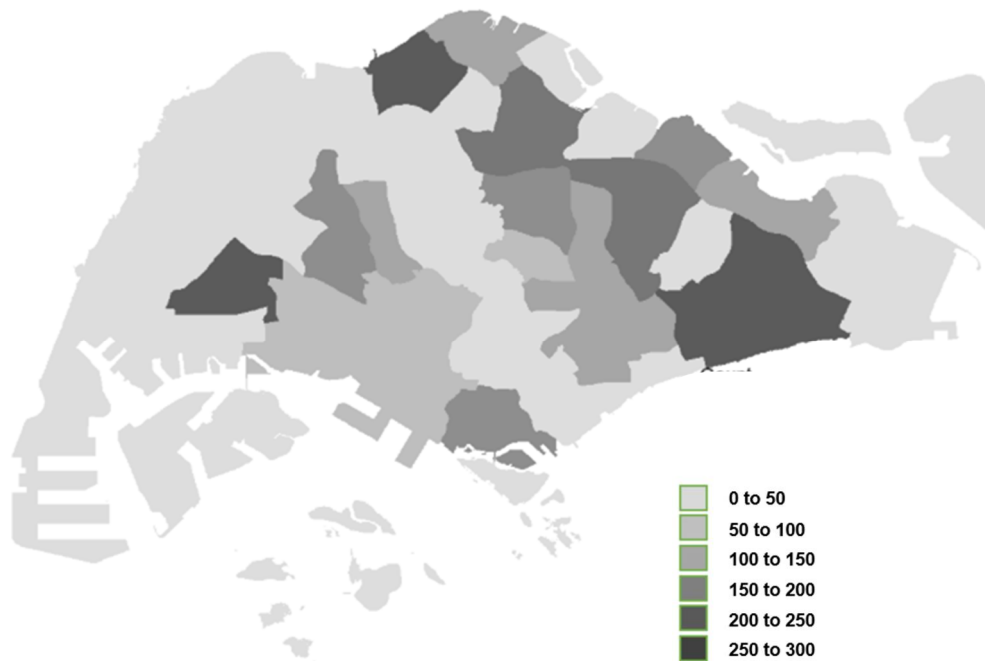
Fig. 7.1 below shows the distribution of dengue clusters in Singapore in the year 2020.

Fig. 7.2 shows the distribution of population in Singapore in the same year.



Source: <https://www.todayonline.com>

Fig. 7.1 Distribution of dengue clusters in Singapore in the year 2020



Source: <https://www.rpubs.com/wadawiz/QiuJunWeiAssignment4>

Fig. 7.2 Distribution of population in Singapore in year 2020 (in thousands)

- (a) The disease is spread by the female *Aedes* mosquito, which transmits the virus from infected humans to other humans through its bites.

State one conclusion based on the information from Fig. 7.1 and Fig. 7.2. Explain your answer.

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.....[2]

- (b) Genetic engineering is used to modify *Aedes* mosquitoes to reduce the spread of diseases like dengue. This technique is also used to produce purple tomatoes to increase its nutritional value by increasing its anthocyanin content, which acts as antioxidants.

Purple tomatoes are genetically engineered by inserting a gene responsible for anthocyanin production, obtained from snapdragon plant, into the tomato plant's DNA. The activated gene results in a purple colour throughout the fruit.

Suggest how this gene is transferred to the tomato plant.

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.....[4]

[Total:6]

- 8 A student investigated the effect of temperature on the rate of respiration in yeast at 25 °C and 35 °C.

- (a) Complete Table 8.1 by choosing the **appropriate results** to calculate the mean volume of carbon dioxide produced.

Table 8.1

Time/ min	Volume of carbon dioxide produced at 35 °C/ cm ³			
	Trial 1	Trial 2	Trial 3	Mean
15	1.8	3.2	2.0	

[1]

- (b) Explain your choice in **part (a)**.

.....
[1]

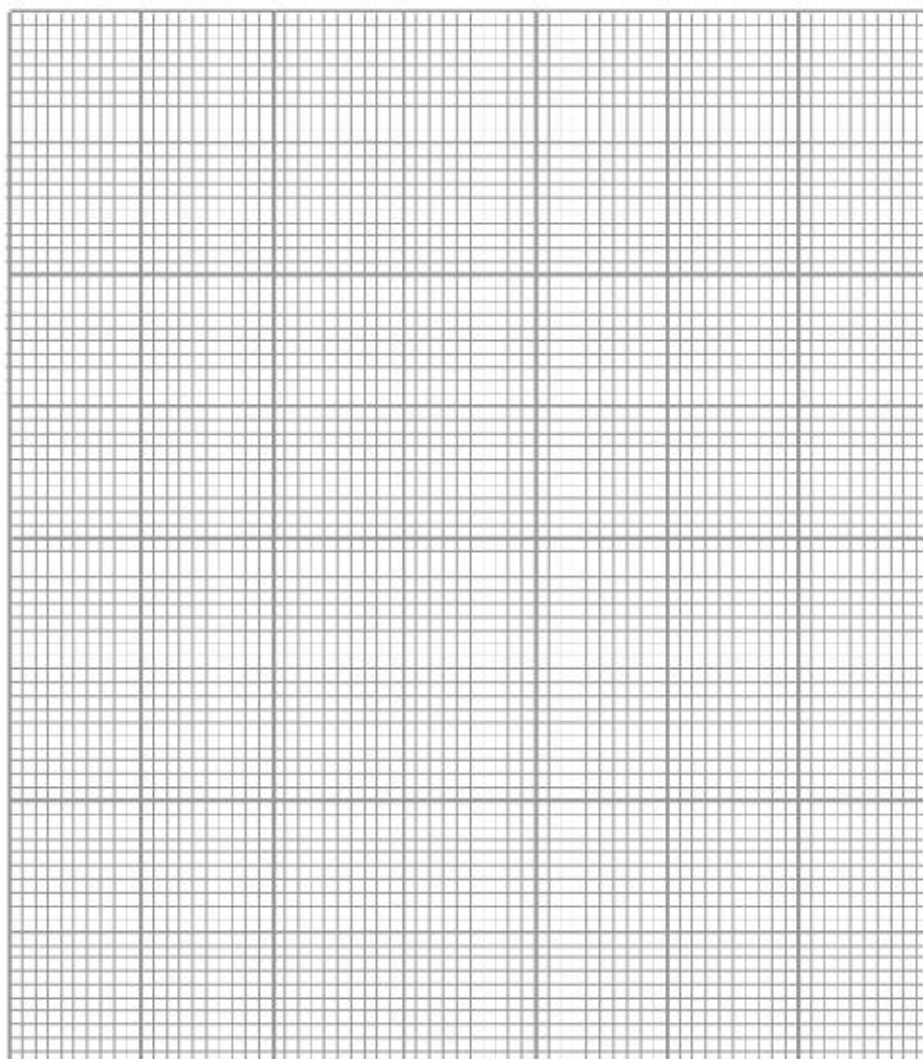
The results of the effect of temperature on the rate of respiration in yeast at 25 °C and 35 °C are shown in Table 8.2.

Complete Table 8.2 using your result from **part (a)**.

Table 8.2

Time/ min	Mean volume of carbon dioxide produced at 25 °C /cm ³	Mean volume of carbon dioxide produced at 35 °C /cm ³
5	0.0	0.1
10	0.0	0.8
15	0.1	
20	0.2	2.7
25	0.5	3.2
30	1.1	3.2

- (c) (i) Plot a graph on the grid below to show how the mean volume of carbon dioxide produced changes with time, using the data in Table 8.2.



[5]

- (ii) With reference to your graph, compare how the rate of respiration in yeast changed with temperature.

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.....[3]

- (iii) Suggest a possible reason for the result between 25 minutes and 30 minutes for the experiment at 35 °C.

.....[1]

[Total:11]

- 9 Plastics are produced in very large amounts by industrial processes around the world. These plastics can enter ecosystems as pollutants.

Many plastics are made from fossil fuels. Oil is not a sustainable resource.

- (a) State what is meant by the term sustainable resource.

.....
[1]

- (b) Most plastics that enter the ecosystem as pollutants are non-biodegradable. Describe one harmful effect of non-biodegradable plastics on each of the following ecosystems:

- (i) aquatic ecosystem

.....
[1]

- (ii) terrestrial ecosystem

.....
[1]

- (c) Plastics contain toxic substances that can reduce the production of hormones involved in the human reproductive system.

Explain, with reference to a **named** hormone, how its reduction can affect the reproductive health in **females**.

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[2]

[Total:5]

Section B

Answer **one** question from this section.

- 10 Fig. 10.1 shows some stages of the human reproduction process.

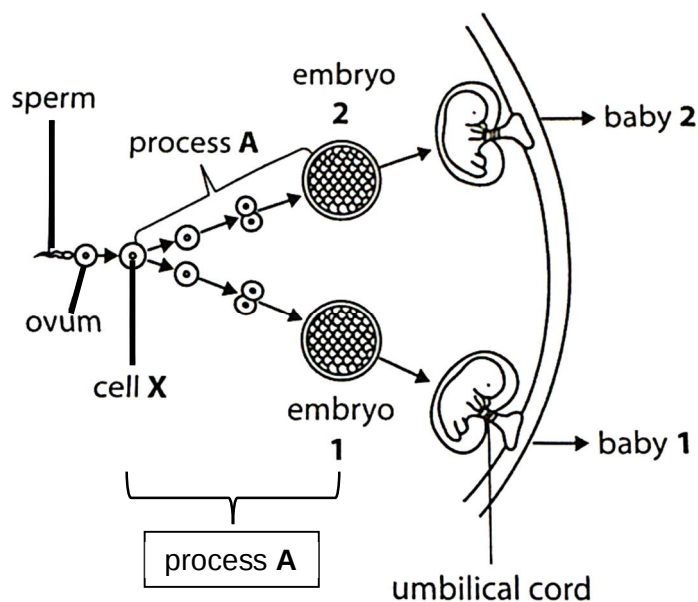


Fig. 10.1

- (a) (i) Name cell **X** and state the process that led to its formation.

cell **X**.....

process that led to its formation.....[2]

- (ii) Process **A** occurs to form embryos **1** and **2** respectively. There is another process in the human body that occurs to produce either the sperm or the ovum.

Compare process **A** and the process that occurs to produce the sperm or the ovum.

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.....[3]

Further development of embryos **1** and **2** will result in the formation of a placenta.

Fig. 10.2 shows the structure of the placentas taken from embryo **1** and embryo **2** respectively.

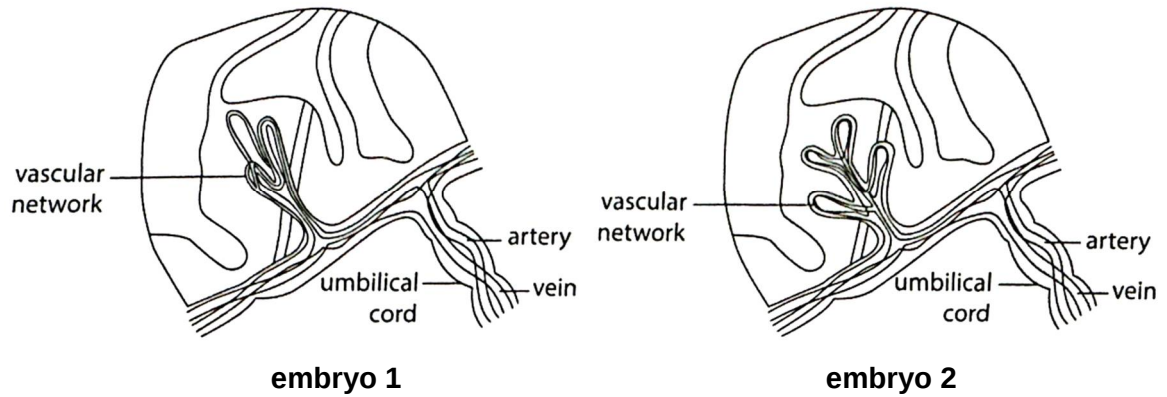


Fig. 10.2

- (b) (i)** State an observable feature that is different between the placentas of the two embryos.

.....
[1]

- (ii)** Suggest and explain the effect of your answer in **part b(i)** on the growth and development of baby **1**.

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[4]

[Total:10]

- 11 (a) Biological processes in plants are affected by environmental factors.

Fig. 11.1 shows the effect of one environmental factor **S**, on transpiration in the plant.

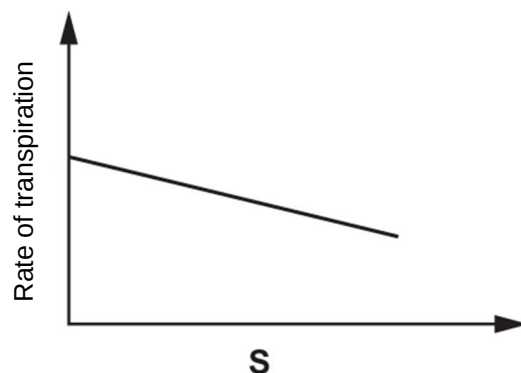


Fig. 11.1

- (i) Identify **S**.

S.....[1]

- (ii) Describe the process of transpiration in the leaf of a plant.

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.....[4]

- (b) All plants carry out photosynthesis. Chlorophyll absorbs light energy for the process of photosynthesis.

(i) State the chemical equation for the process of photosynthesis.

.....[1]

- (ii) Fig. 11.2 shows part of a young growing plant in a pot of soil. Leaf **F** was placed in a sealed transparent flask containing radioactive carbon dioxide. It was then left in the light.

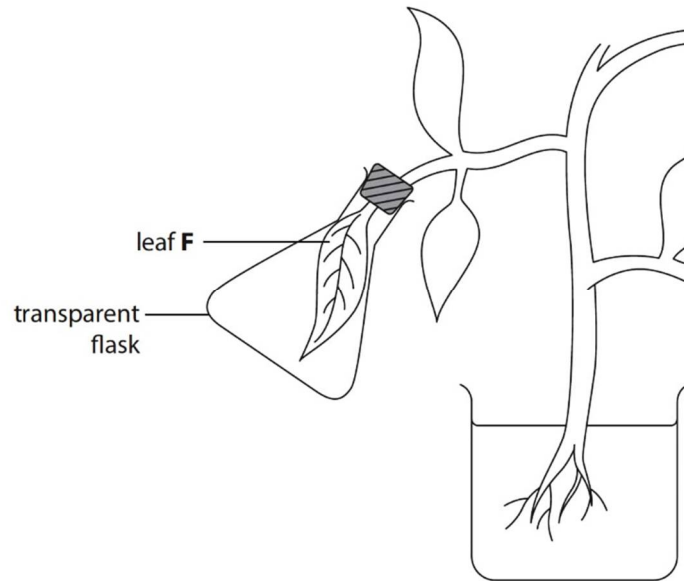


Fig. 11.2

After six hours, radioactive carbon was found in the leaves, roots and the soil.

Explain the presence of the radioactive carbon in the **roots and soil**.

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.....[4]

[Total:10]

End of Paper