



Cambridge O Level

CANDIDATE
NAME



CENTRE
NUMBER

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BIOLOGY

5090/22

Paper 2 Theory

May/June 2025

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [].

This document has **16** pages. Any blank pages are indicated.



Answer **all** questions.

Write your answers in the spaces provided.

- 1 A pea seed is planted in a pot containing soil and provided with the ideal conditions for germination. The pot is left in a dark room for 10 days.

Fig. 1.1 shows the appearance of the germinating seed on different days.

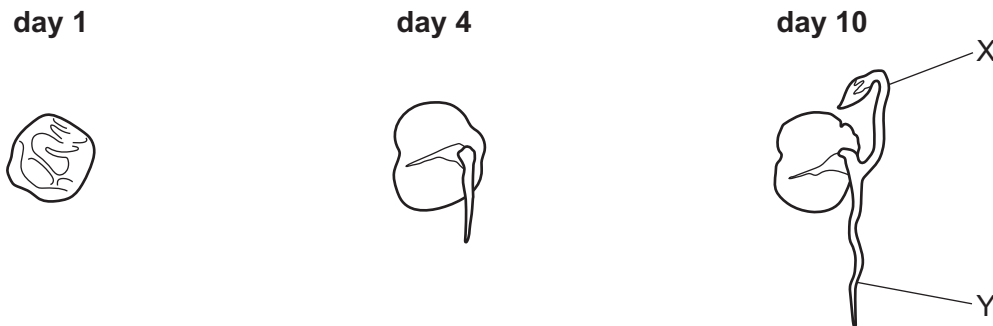


Fig. 1.1

- (a) Describe the conditions required for seeds to germinate.

.....

.....

..... [3]

- (b) Fig. 1.1 shows that the seed changes between day 1 and day 4.

Describe these changes and explain how they happen.

.....

.....

.....

.....

.....

.....

..... [5]





(c) Fig. 1.1 shows that after 10 days the structures labelled X and Y have developed from parts of the seed.

(i) Name the part of the seed that X has developed from.

..... [1]

(ii) The seed is germinating in darkness.

Explain what causes X and Y to grow in opposite directions.

.....
.....
.....
..... [2]

[Total: 11]





- 2 Scientists have been thinking about how to feed the human population of the planet in a healthy and sustainable way.

They have produced a model called the planetary health plate. This is shown in Fig. 2.1.

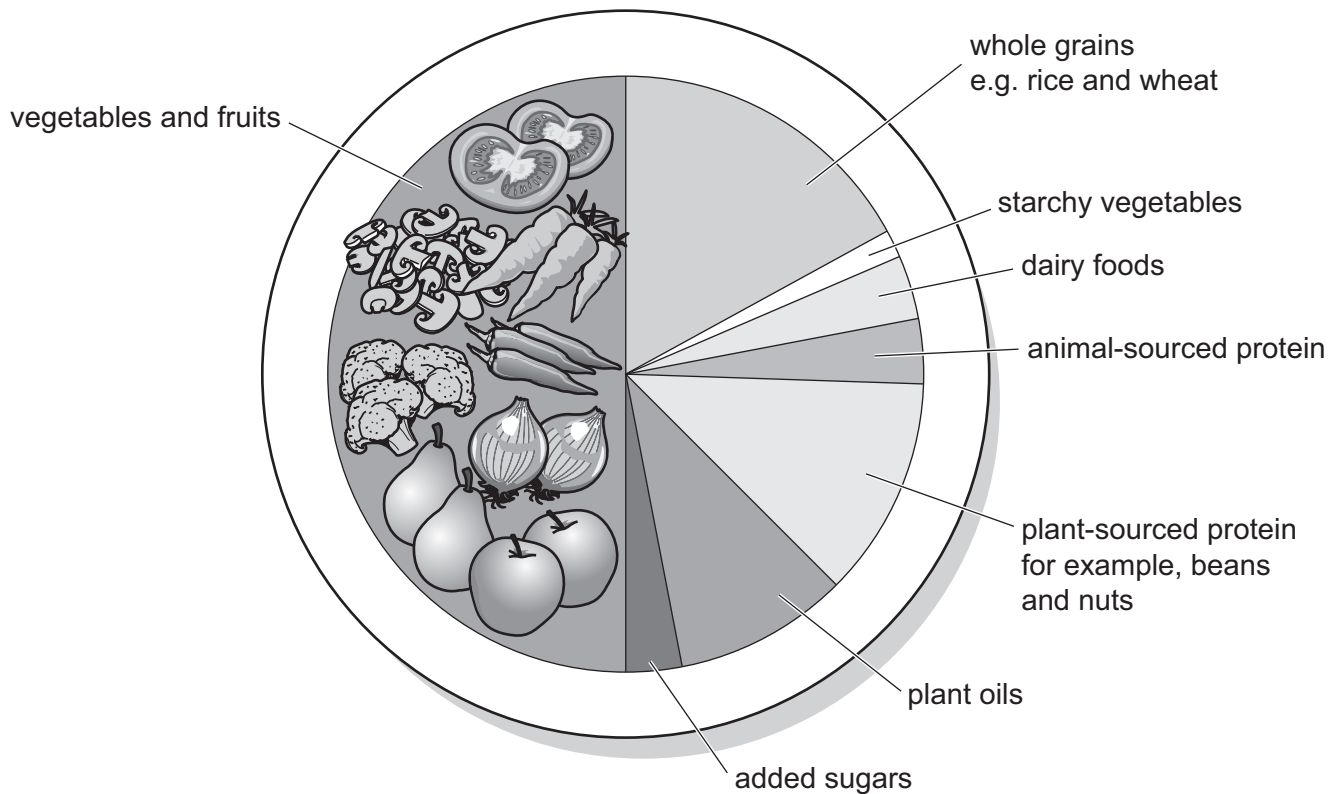


Fig. 2.1

- (a) (i) The vegetables and fruits provide some of the protein, carbohydrates and lipids needed in a balanced diet.

Name **three** other components of a balanced diet that can be obtained from vegetables and fruits.

1

2

3

[3]

- (ii) State **two** reasons why plant oils and other lipids are important in the human diet.

1

2

[2]



- (b) Table 2.1 shows the recommended daily average intake of sources of protein, from animals and plants, in the planetary health plate model.

Table 2.1

food	protein source	recommended average intake /g per day
red meat	animal	14
poultry	animal	29
eggs	animal	13
fish	animal	28
legumes	plant	75
nuts	plant	50

- (i) Use Table 2.1 to calculate the percentage that plant protein sources contribute to the recommended average daily protein intake for humans.

Space for working.

..... % [2]

- (ii) The global average daily human intake of **red meat** is approximately 300% of the recommended amount.

Calculate how much red meat an average human eats in a year (365 days).

Give your answer in kilograms.

average yearly intake = kg [2]





- (c) It is more energy efficient for humans to eat plants.

Explain why.

.....

.....

.....

..... [2]

- (d) If humans reduce the amount of animal protein they eat, then less agricultural land is required.

Suggest **three** environmental benefits of reducing the amount of land used for agriculture.

1

.....

2

.....

3

..... [3]

[Total: 14]



- 3 *Staphylococcus aureus* is a pathogen which infects humans. It can be destroyed by antibodies and antibiotics.

The cells of this bacterium are spherical and about $1\text{ }\mu\text{m}$ in diameter.

Fig. 3.1 shows a diagram of an *S. aureus* cell.

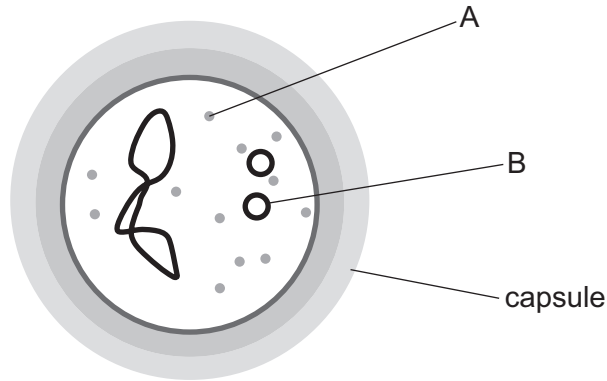


Fig. 3.1

- (a) (i) Name parts A and B.

A

B

[2]

- (ii) Part A can also be found in animal and plant cells.

State **two** other components of this bacterial cell that can also be found in animal **and** plant cells.

1

2

[2]

- (iii) Antibodies can destroy bacterial cells without destroying human cells.

Explain how this is possible.

.....

 [3]





- (b) There are different types or strains of *S. aureus* cells and some can resist antibiotics better than others.

A disc diffusion test is carried out to investigate the resistance of four strains of *S. aureus* (**K**, **L**, **M** and **N**) to different antibiotics. The four strains are first grown to cover the surface of separate agar plates. Then discs containing six different antibiotics (1–6) are placed on the agar plates.

Fig. 3.2 shows the results of the investigation after several days.

Any clear zones indicate where *S. aureus* has died.

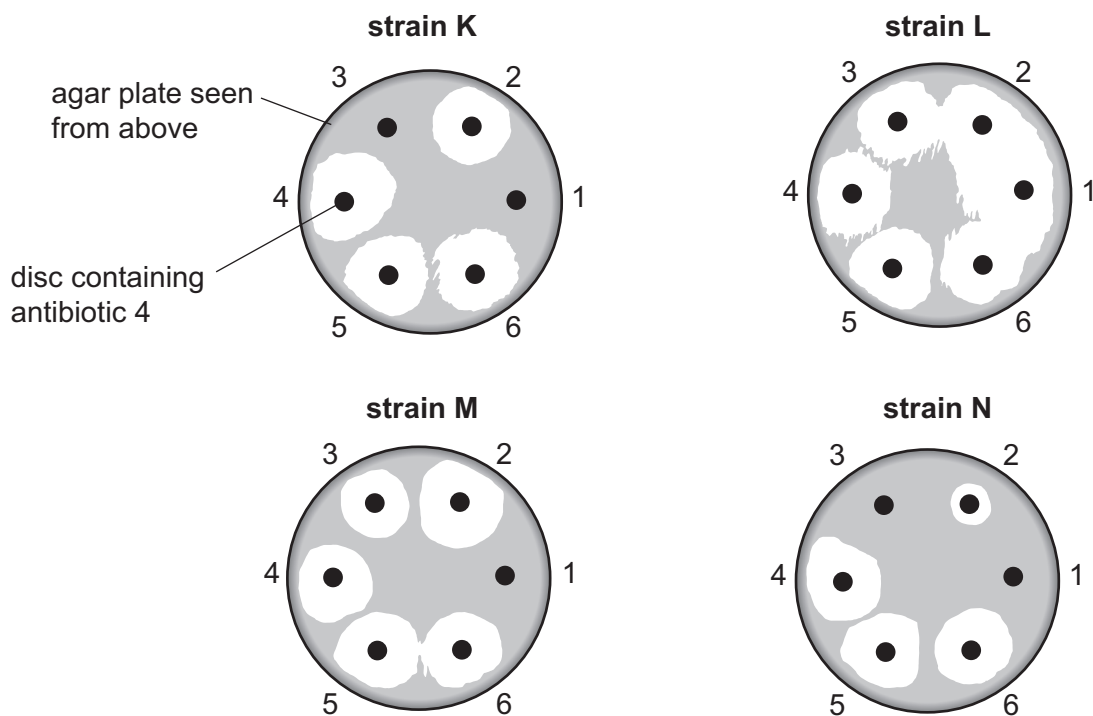


Fig. 3.2

- (i) Suggest why this is called a disc diffusion test.

.....
 [1]

- (ii) Describe what these results show about the effectiveness of antibiotics 1 and 5.

antibiotic 1

 antibiotic 5
 [2]





(c) Over time the percentage of each strain in the *S. aureus* population will change.

- (i) Suggest which strain, **K**, **L**, **M** or **N**, in Fig. 3.2 is likely to become the largest percentage of the population.

..... [1]

- (ii) Explain why the strain named in (c)(i) is likely to become the largest percentage of the population over time.

.....
.....
.....
.....
.....
.....
.....
.....
..... [5]

[Total: 16]





- 4 Fig. 4.1 shows a human bronchiole and some of the specialised cells from the inner layer that surrounds the lumen.

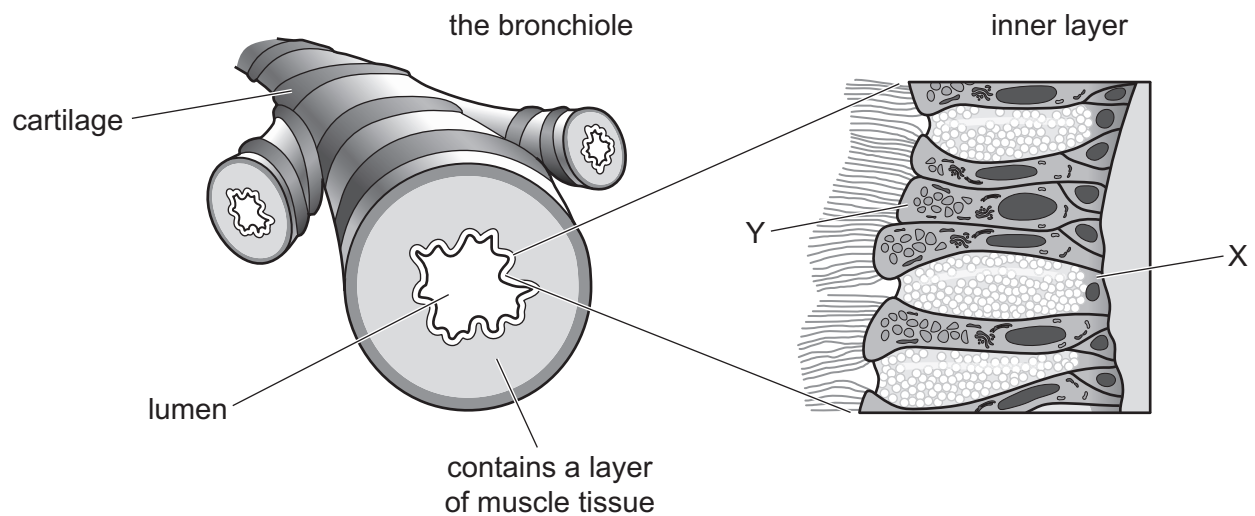


Fig. 4.1

- (a) (i) Name the cell labelled X and describe its function.

X

function

.....

.....

[3]

- (ii) Name the cell labelled Y and describe its function.

Y

function

.....

.....

[2]





(b) The muscle layer in the walls of the bronchi and bronchioles sometimes contracts causing the lumens to narrow. This is called bronchoconstriction. One substance that triggers contraction is nicotine.

(i) Suggest the effects of bronchoconstriction on a person.

.....

.....

.....

..... [3]

(ii) Describe **one** effect of nicotine on the circulatory system.

.....

..... [1]

[Total: 9]





- 5 *Rhizomucor pusillus* is a fungus found in piles of dead plant vegetation. It has an optimum growth rate between 60 °C and 70 °C.

(a) (i) Identify the name of the kingdom and genus of this organism.

kingdom

genus

[1]

(ii) Give **two** of the main features of organisms classified in the kingdom named in (a)(i).

1

2

[2]

(iii) Explain how piles of dead plant vegetation can have temperatures much higher than the surrounding environment.

.....

.....

.....

.....

.....

..... [4]



- (b) This fungus produces an enzyme called pectinase. Scientists extracted pectinase from the fungus and investigated the effect of pH on its activity at 20 °C.

Fig. 5.1 shows a graph of their results.

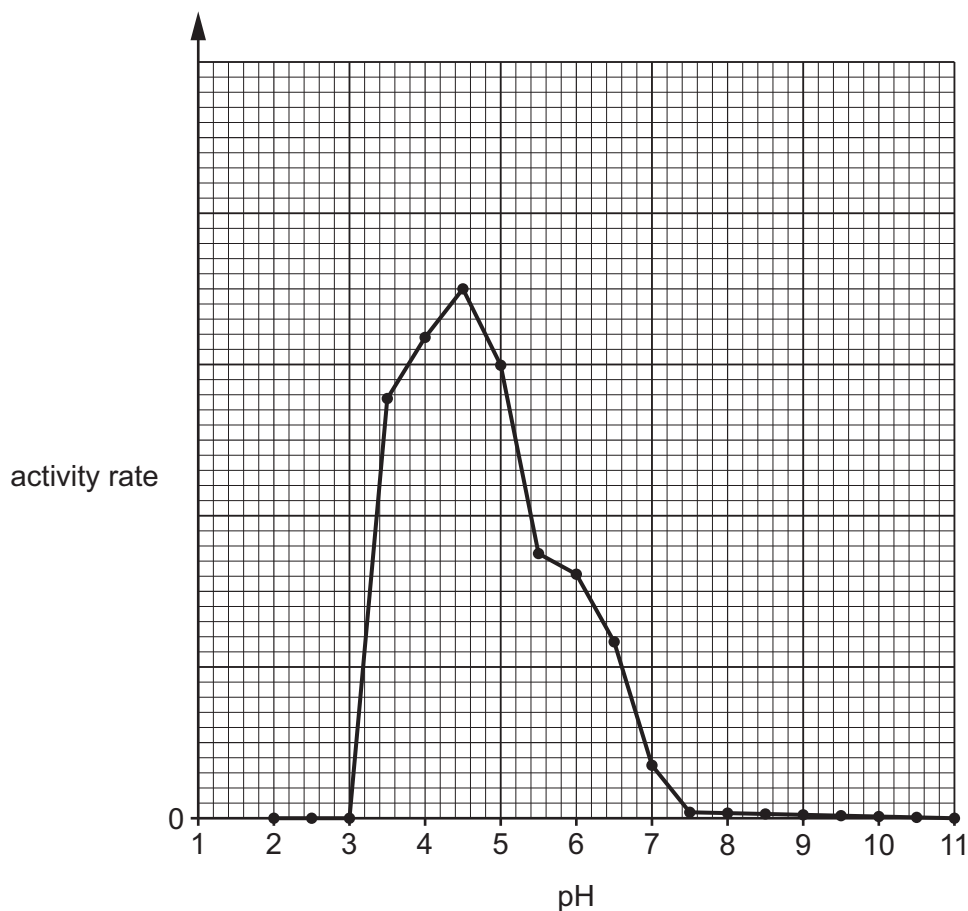


Fig. 5.1

- (i) Explain the results for the pH range 2–7.

.....

.....

.....

.....

..... [4]

- (ii) The experiment was repeated at a temperature of 55 °C.

On Fig. 5.1, draw a graph to suggest the results expected at 55 °C. [1]

- (iii) Name an industrial process that uses pectinase.

..... [1]

[Total: 13]



- 6 The nucleus of a cell contains DNA molecules that control cell function.

Fig. 6.1 is a diagram showing one of these DNA molecules.

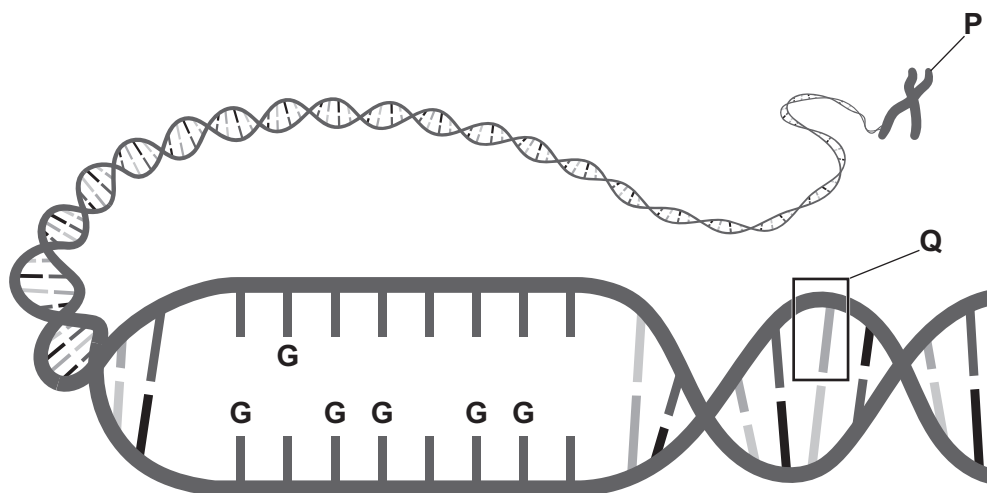


Fig. 6.1

- (a) Using information from Fig. 6.1:

- (i) state the name of the structure labelled **P**

..... [1]

- (ii) state the name of the unit of DNA labelled **Q**

..... [1]

- (iii) state the letter of the base that pairs with **G**.

..... [1]

- (b) Explain how this DNA molecule controls cell function.

Include an example in your answer.

.....

.....

.....

.....

.....

..... [4]





(a) Explain how the structure of a leaf is adapted for photosynthesis.

[6]

Discuss this statement.

[4]

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