Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2418805993

BIOLOGY **5090/21**

Paper 2 Theory **October/November 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 **20** pages. Any blank pages are indicated.

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1 Fig. 1.1 shows the female human reproductive system as viewed from the front.

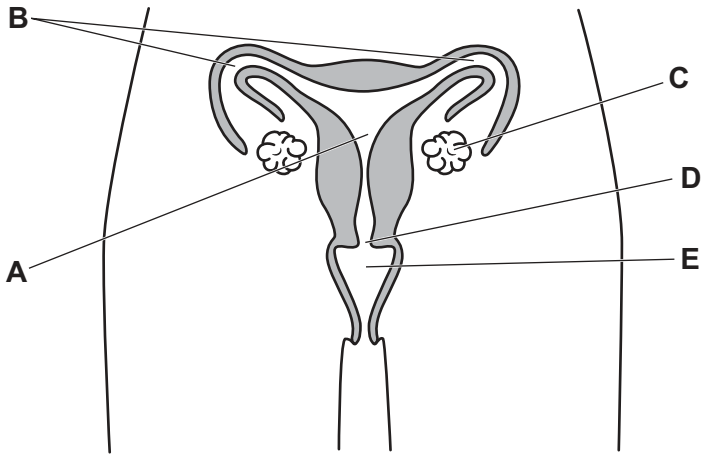

Fig. 1.1

(a) Identify the letter on Fig. 1.1 that has been used to label the area where each of the following happens:

where sperm is deposited .....

where oestrogen is produced .....

where implantation occurs. .....

[3]

(b) Some women can have blockages in the tubes labelled **B**.

Explain why this would prevent them becoming pregnant.

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(c) *In vitro* fertilisation (IVF) can be used to help women who have blocked tubes to get pregnant. It involves several steps.

step 1 The ovaries are stimulated to produce a large number of eggs.
step 2 The eggs are removed from the ovaries before they are released naturally.
step 3 The eggs are fertilised with sperm.
step 4 The fertilised eggs are replaced into the uterus.

(i) In step 1, the patient is injected with a hormone.

Name a hormone that could be used.

..... [1]

(ii) In step 2, a drug is used to stop the action of luteinising hormone (LH).

Explain why it is important to stop the action of LH.

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..... [2]

(iii) When a man and a woman are unable to have children, they are said to be an infertile couple.

There are estimated to be 90 million infertile couples in the world.

There are many causes of infertility but 17% of cases are due to blocked tubes in women.

Calculate the number of couples in the world whose infertility is due to blocked tubes in women.

Give your answer in standard form.

Space for working.

number of couples = ... [3]

[Total: 11]

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2 Fig. 2.1 shows a section through the human eye.

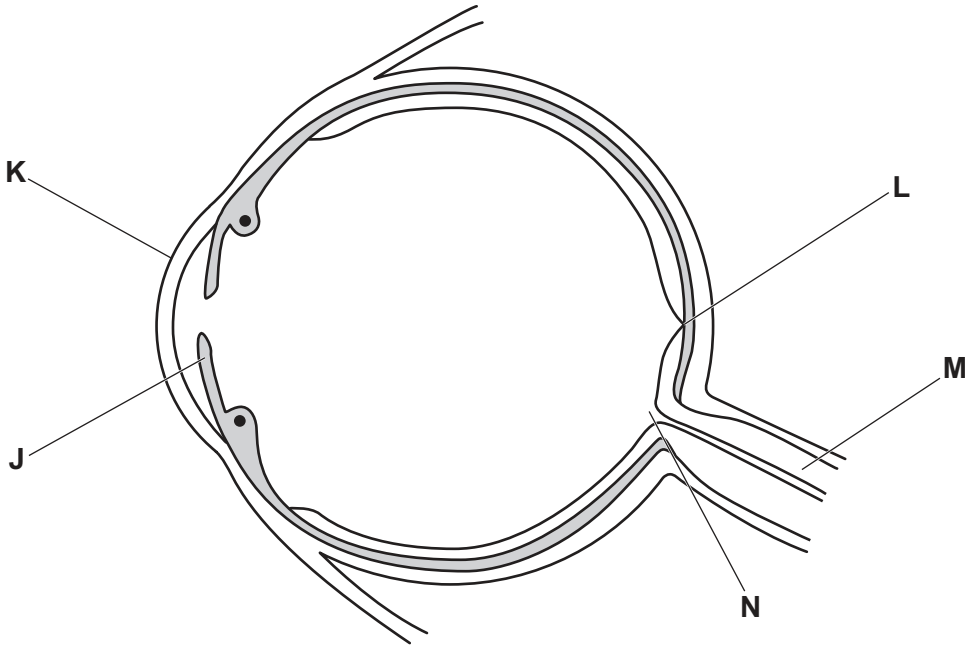

Fig. 2.1

(a) (i) Identify the letter on Fig. 2.1 that has been used to label the part of the eye that:

contains circular and radial muscles .....

has the highest concentration of light receptors. .....

[2]

(ii) On Fig. 2.1, draw **and** label:

- the lens
- the suspensory ligaments.

[2]

(iii) Explain the function of the suspensory ligaments.

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(b) Some people have a genetic condition called cornea plana. This condition causes the cornea to be flatter than usual.

(i) Explain why a person with cornea plana **cannot** see some objects clearly.

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..... [2]

(ii) One type of cornea plana is caused by a recessive allele.

Two people who do **not** have cornea plana have a child who has the condition.

Explain how this is possible.

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[Total: 11]

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3 **(a)** Fig. 3.1 shows a summary of protein metabolism in the body.

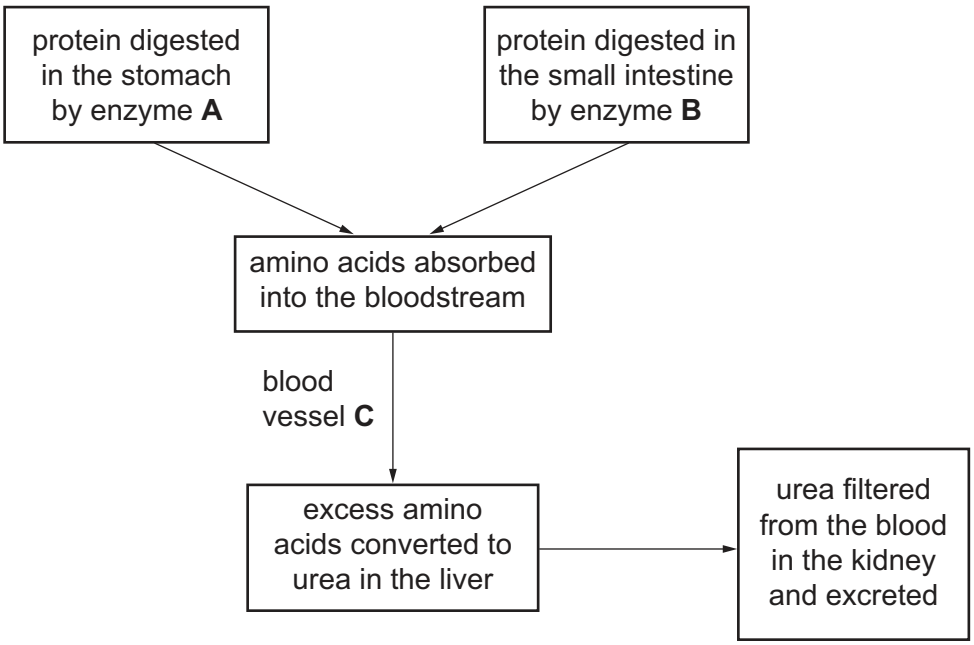

Fig. 3.1

Use Fig. 3.1 to answer these questions.

(i) State the name of enzyme **A** and enzyme **B**.

enzyme **A** .....

enzyme **B** .....

[2]

(ii) State the name of blood vessel **C**.

..... [1]

(iii) Name the capillary structures in the kidney that filter urea from the blood.

..... [1]

(b) Two groups of students, **X** and **Y**, investigate the effect of different diets on the concentration of urea in their urine.

For one day, the two groups eat different foods:

- group **X** eat bread, jam, orange juice, lettuce, fruit
- group **Y** eat nuts, milk, bread, cheese, meat.

Early the next morning, they collect and analyse their urine to measure the concentration of urea.

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Table 3.1 shows their results.

Table 3.1

	concentration of urea / g per 100 cm^3 of urine	
	individual students	mean
group **X**	1.5, 1.7, 2.3, 1.6, 2.1, 1.4	1.8
group **Y**	1.8, 1.9, 2.3, 2.5, 1.9, 2.4	

(i) Calculate the mean concentration of urea for the students in group **Y**.

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

Space for working.

mean concentration of urea = ... g per 100 cm^3 of urine [2]

(ii) Explain the difference in the mean concentration of urea for the two groups of students.

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..... [3]

(iii) One of the students said: 'To make a fair comparison, we should have made sure that the students in each group drank the same volume of water'.

Explain why this student is correct.

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[Total: 11]

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4 Chlorophyll is found in all organisms that photosynthesise.

(a) Complete these sentences about chlorophyll by writing suitable words in the gaps.

A chlorophyll molecule contains carbon, hydrogen, oxygen, nitrogen and an atom of

..... .

Chlorophyll molecules are found in plant cells in structures called

..... .

The type of leaf cells that contain the most chlorophyll are the

..... cells.

Chlorophyll molecules trap sunlight energy and this is used by plants to produce glucose.

Glucose can then be converted to ..... to be transported around the plant.

Glucose can also be converted to ..... to make cell walls.

[5]

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(b) Mistletoe is a parasitic green plant that can often be seen growing attached to trees.

Fig. 4.1 shows some mistletoe growing on the branch of a tree.

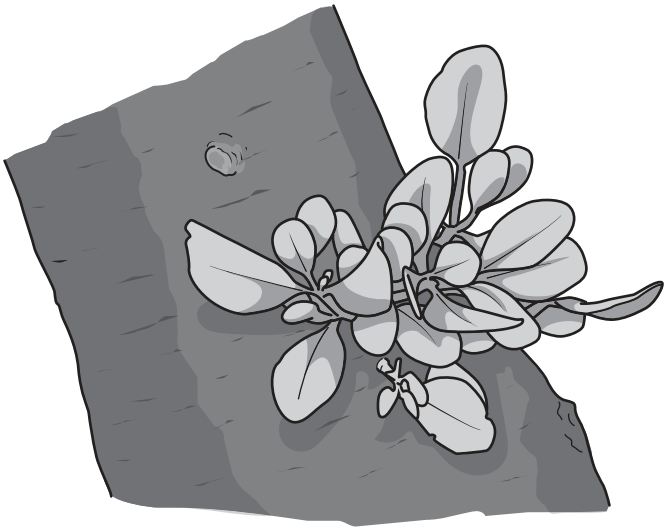

Fig. 4.1

Most plants have about 1 mg of chlorophyll in 100 g of their leaves.

Mistletoe, however, has about 0.4 mg of chlorophyll in 100 g of its leaves.

Mistletoe seeds are stuck to the branches of trees by birds. The seeds germinate to produce special roots that grow into the phloem of the tree branch.

Suggest why mistletoe grows these special roots.

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5 **(a)** Fig. 5.1 shows a model of the human circulatory system.

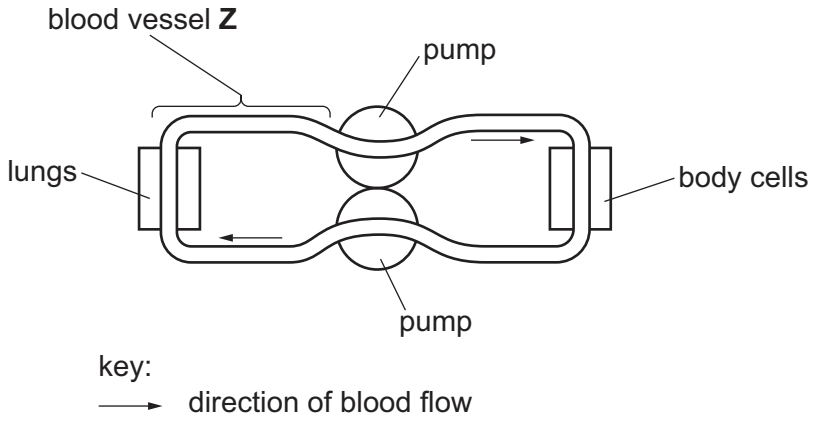

Fig. 5.1

(i) Give the name of the blood vessel represented by **Z** in Fig. 5.1.

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[1]

(ii) The system is described as a double circulatory system.

Describe what is meant by a double circulation.

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..... [2]

(iii) Explain how the structure of the human heart is adapted to be the pump in a double circulatory system.

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(b) Some people have a heart defect called a 'hole in the heart', as shown in Fig. 5.2.

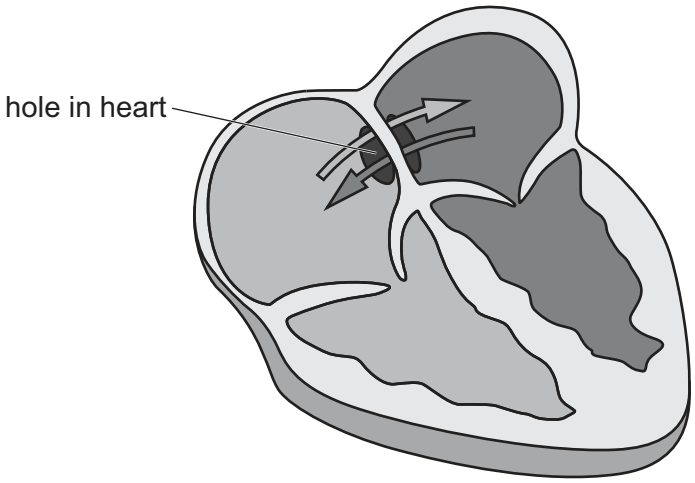

Fig. 5.2

People with a hole in their heart may develop pain in their muscles and quickly become tired when they exercise.

Explain why this happens.

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[Total: 10]

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6 Biofuels are made from plant material or animal waste. They are used as a replacement for fossil fuels such as petrol and oil.

Fossil fuels were made over long periods of time, millions of years ago.

Biofuels may or may **not** be a sustainable resource.

(a) Describe what is meant by a sustainable resource.

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..... [2]

(b) Alcohol (ethanol) is used as a biofuel. It can be made from plants, such as sugar cane, which grow in tropical countries such as Brazil.

Describe how a living organism can be used to convert sugar found in plants into alcohol.

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(c) Fig. 6.1 gives some information about alcohol production and deforestation in Brazil from 2012 to 2016.

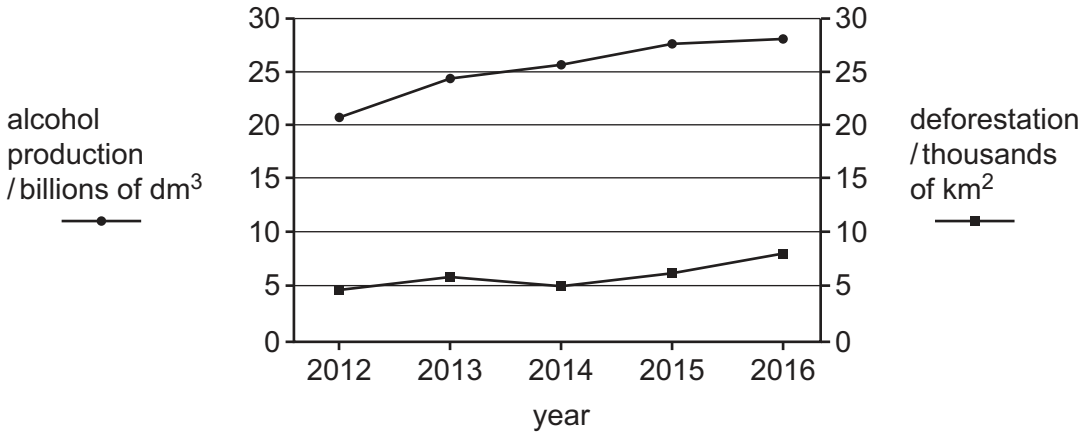

Fig. 6.1

Suggest an explanation for the changes shown in Fig. 6.1 and describe the possible impact of these changes.

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7 HIV and MRSA are two different microorganisms which are pathogens.

(a) (i) Put ticks (✓) in Table 7.1 to show the characteristics of each pathogen.

Table 7.1

characteristic	HIV	MRSA
is a living cell		
contains cytoplasm		
contains genetic material		
has a protein coat		

[2]

(ii) Describe how HIV affects the human immune system.

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(iii) For different reasons, HIV and MRSA are **not** destroyed by antibiotics such as penicillin.

Give these reasons.

HIV .....

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MRSA .....

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[2]

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(b) Fig. 7.1 shows the number of people infected by the MRSA pathogen in different countries.

It also shows the total amount of antibiotics used in each country in one year per 1000 people.

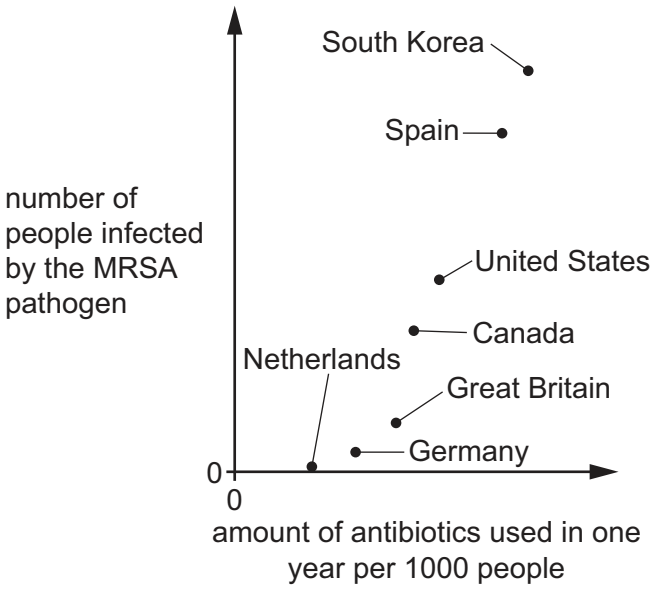

Fig. 7.1

Describe and explain the relationship shown between antibiotic use and the number of people infected by the MRSA pathogen.

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8 Fig. 8.1 shows a synapse between a sensory neurone and a relay neurone.

The sensory neurone receives information from a pain receptor.

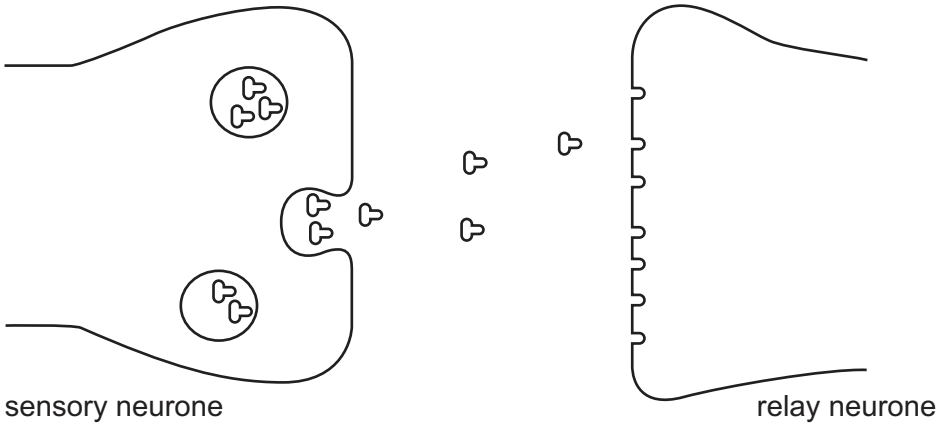

Fig. 8.1

(a) Explain how impulses in the sensory neurone can stimulate the relay neurone.

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(b) Analgesics are drugs that help to stop a person from feeling pain.

Fig. 8.2 shows the shape of some analgesic drug molecules.

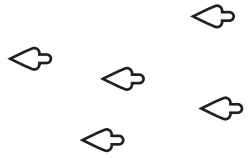

Fig. 8.2

Suggest how this analgesic drug can help to stop a person from feeling pain.

Use information from Fig. 8.1 and Fig. 8.2 in your answer.

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