Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **5090/21**

Paper 2 Theory **October/November 2023**

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.

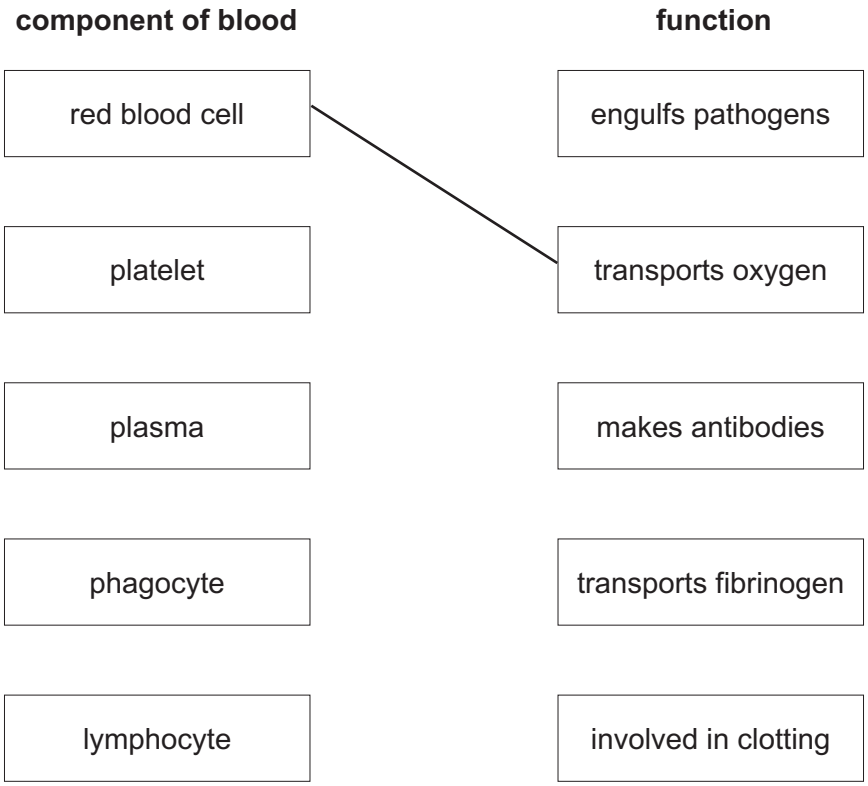
INFORMATION

- 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.

[Turn over

1 **(a)** Human blood has many different components and functions.
Match each component to its function by drawing a line between them. One has been done for you.



[3]

(b) **(i)** Explain how a red blood cell is specialised for transporting oxygen.

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..... [3]

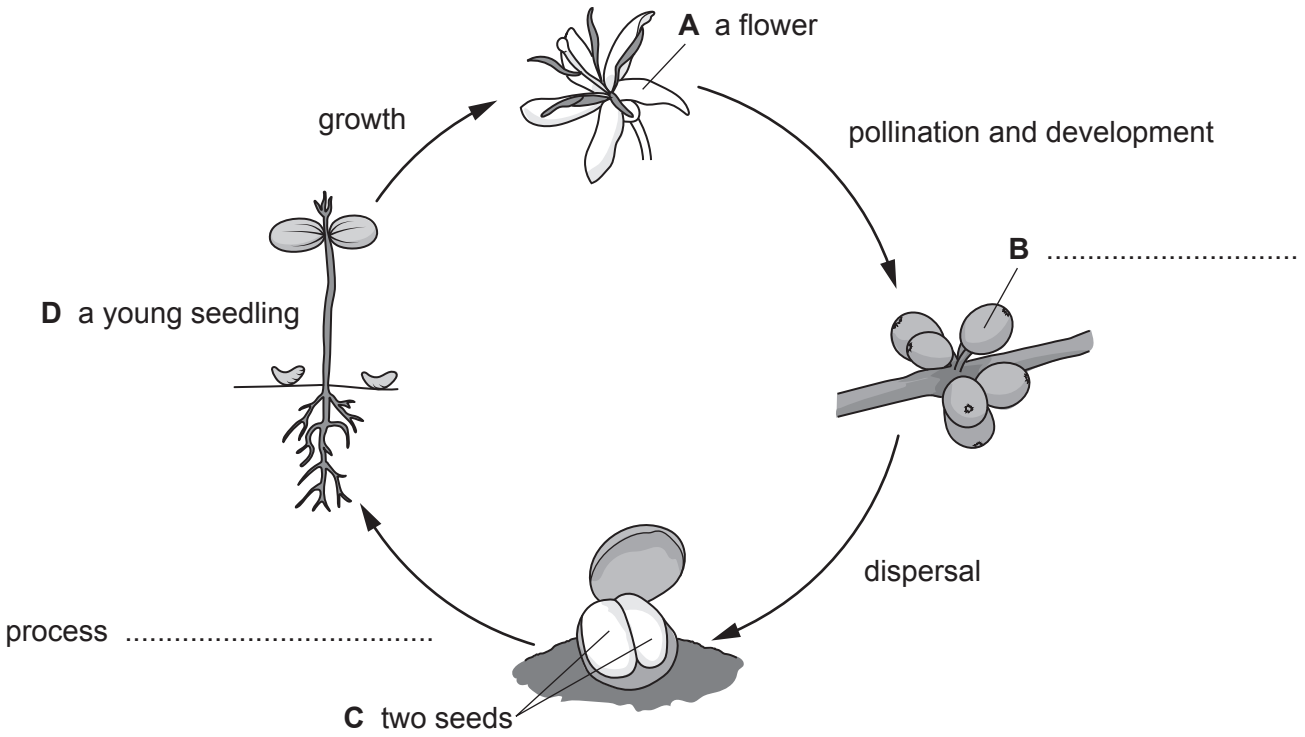
(ii) The number of red blood cells in 1 mm^3 of blood is called a red blood cell count.
A normal red blood cell count for a female is 4.2 – 5.4 million cells in 1 mm^3 of blood.
Suggest **two** factors that could lead to a change in the red blood cell count in a 25 year-old female.

1 .....

2 .....
[2]

[Total: 8]

2 Fig. 2.1 shows the life cycle of the plant *Coffea arabica*.
This plant produces seeds which are used to make coffee.



(not to scale)

Fig. 2.1

(a) (i) Complete Fig. 2.1 by labelling the plant structure **B** and the process taking place between **C** and **D**. [2]

(ii) The flowers produce nectar in nectaries and are pollinated by insects, such as bees.
Suggest where the nectaries are located and how this assists the process of pollination.

.....

.....

..... [2]

(iii) After pollination, pollen tubes grow down the style.
Describe what then happens leading to the formation of **B** and its contents.

.....

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.....

..... [3]

(b) *Coffea arabica* plants produce a chemical called caffeine which in high concentrations is toxic to insects.

(i) Suggest why the production of caffeine is useful to the plant.

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..... [1]

(ii) Caffeine is found throughout the plant but in some parts the concentration is much higher than in others.
Suggest why it is important to the plant to have different concentrations in different parts.

.....

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..... [2]

(c) Coffee is a drink that many humans enjoy.
The caffeine in the coffee causes the body to release adrenaline.

(i) Using caffeine and adrenaline as examples, explain the difference between a drug and a hormone.

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.....

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..... [3]

(ii) Suggest **two** effects on the body of drinking coffee that contains caffeine.

1 .....

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2 .....

.....
[2]

[Total: 15]

3 The bar chart in Fig. 3.1 shows the percentage of total human body mass for the five most common elements found in the human body.

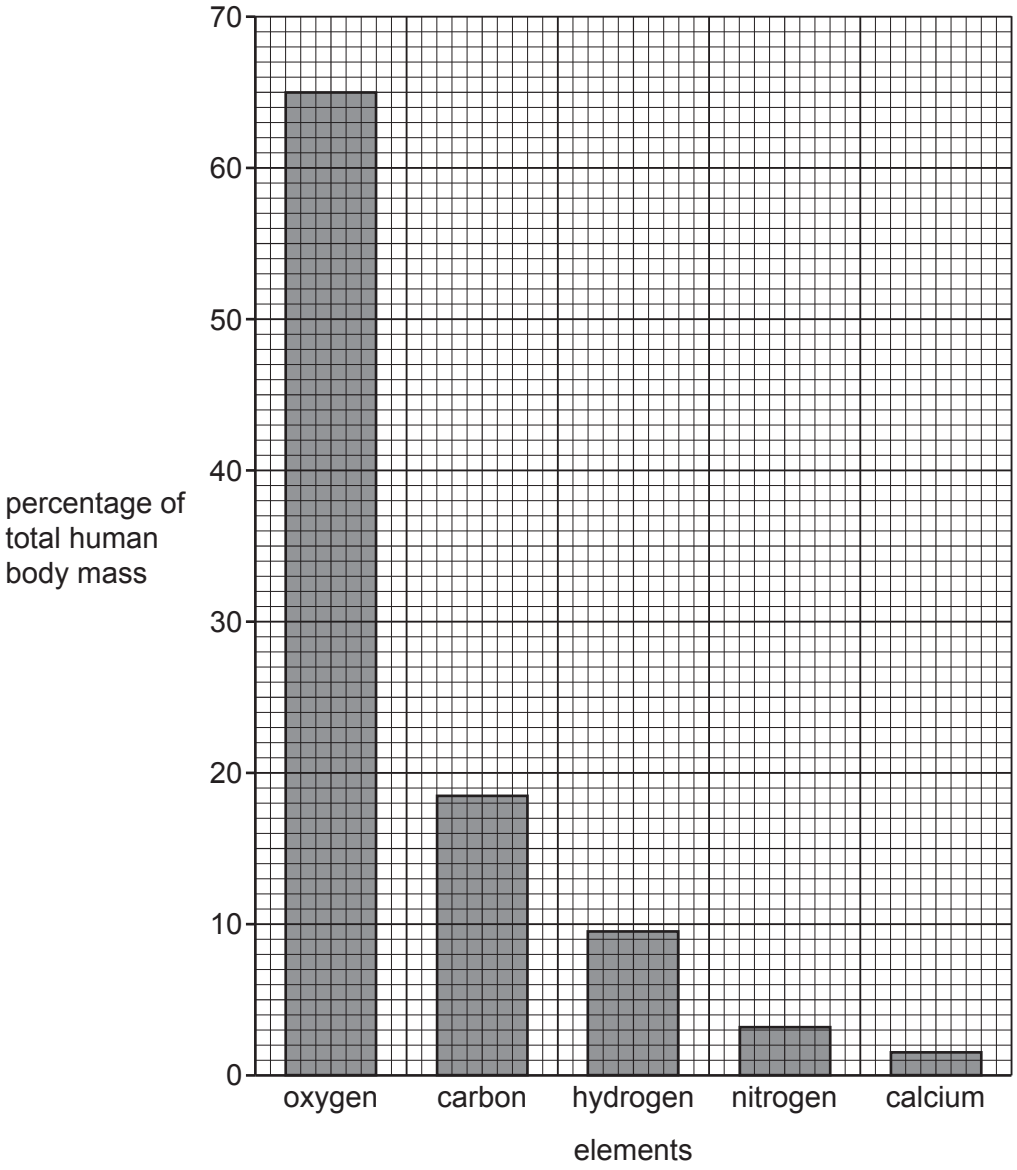

Fig. 3.1

(a) (i) Calculate the percentage of the total human body mass made up from the **three** most common elements.

total = ... % [2]

(ii) Name **two types** of substance found in the human body that contain only carbon, hydrogen and oxygen.

1 .....

2 .....

[2]

(b) Water contains the elements hydrogen and oxygen and makes up a large percentage of an adult's total body mass.

(i) Discuss why water makes up such a high percentage of an adult's total body mass.

.....

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..... [3]

(ii) Explain why a cell from human tissue will burst when it is placed in water.

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..... [3]

(c) Human tissues contain different percentage masses of the elements shown in Fig. 3.1.
Suggest **one** tissue that contains a relatively high percentage mass of nitrogen and explain your answer.

.....

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..... [2]

[Total: 12]

4 A sneeze can be triggered by dust irritating receptor cells in the lining of the nose or throat. During a sneeze, air is exhaled from the lungs with some force and the eyelids close.

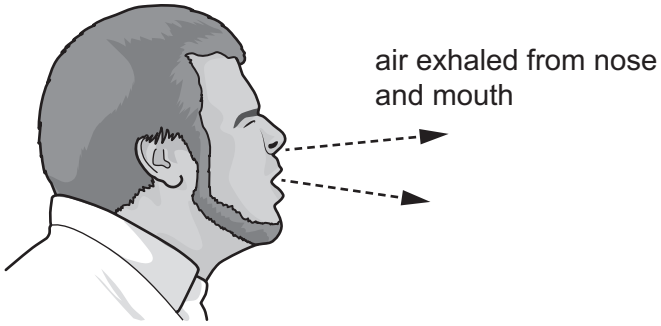

Fig. 4.1

(a) **(i)** Suggest how the closure of the eyelids during a sneeze is coordinated.

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..... [4]

(ii) Suggest how sneezing can result in disease transmission.

.....

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..... [2]

(b) A sudden increase in light intensity can trigger sneezing in some people. This is called photic sneezing. It is estimated that 18 – 35% of the human population can be triggered to sneeze by an increase in light intensity.
The genetic basis for photic sneezing is not fully understood but it is thought that a dominant allele is involved.

(i) Give the name of this type of variation in a population and explain your answer.

type of variation .....

explanation .....

.....
[2]

(ii) Describe what is meant by the term *dominant allele*.

.....

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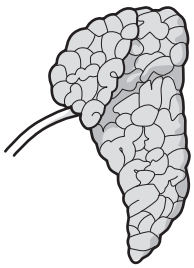
..... [2]

[Total: 10]

5 Fig. 5.1 shows two structures found in the human digestive system.

a tooth

a salivary gland



(not to scale)

Fig. 5.1

(a) (i) Identify the type of tooth shown in the diagram.

..... [1]

(ii) Name the outer layer of the tooth.

..... [1]

(iii) Explain how the tooth and the salivary gland contribute to digestion in different ways.

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..... [4]

(b) The stomach wall produces different substances that are involved in digestion.

(i) Name **two** of these substances and explain how they are involved in digestion.

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..... [4]

(ii) A hormone called gastrin stimulates cells in the stomach wall to release the substances involved in digestion. Some of the gastrin is produced in the duodenum.

State how this gastrin reaches the stomach.

..... [1]

[Total: 11]

6 Fig. 6.1 shows a biological molecule.

Fig. 6.1

(a) (i) Name this molecule.

..... [1]

(ii) Describe **three** features of the structure of this molecule.

1 .....

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2 .....

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3 .....

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[3]

(b) Animal and bacterial cells contain this molecule.
Describe how the location and shape of the molecule differ in animal and bacterial cells.

location .....

.....

shape .....

.....

[2]

(c) Explain how this molecule controls cell function.

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..... [3]

[Total: 9]

7 **(a)** A root hair cell in a plant is respiring aerobically.

(i) Name the structures within the cell that carry out aerobic respiration.

..... [1]

(ii) Write the balanced symbol equation for the aerobic respiration of glucose, $C_6H_{12}O_6$.

..... ⟶ .....
[2]

(b) The plant experiences changing weather conditions including:

high temperature **heavy rain** **high winds** **low humidity**

State the weather condition that may lead to a root hair cell respiring anaerobically and explain your answer.

weather condition .....

explanation .....

.....
[2]

[Total: 5]

8 **(a)** The number of individuals in a population can vary with time.
Table 8.1 shows how the global populations of humans and tigers are estimated to have changed between 1970 and 2000.

Table 8.1

year	estimated global population	
	humans	tigers
1970	3.6 billion	35 000
2000	6.0 billion	5 000

Suggest factors that may be causing these changes in the two populations and how the changes may be linked.

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..... [6]

(b) In 2010 the population of tigers had dropped to an estimated 3200.
Thirteen countries in which tigers live signed an agreement to double their tiger populations by 2022.
Explain why it is important to increase tiger populations and suggest ways of doing this.

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..... [4]

[Total:10]

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