Cambridge Assessment International Education

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BIOLOGY **0610/04**

Paper 4 Theory (Extended) **For examination from 2023**

SPECIMEN PAPER **1 hour 15 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 **18** pages. Any blank pages are indicated.

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1 **(a)** Fig. 1.1 is a photomicrograph showing a surface view of many villi in the small intestine.

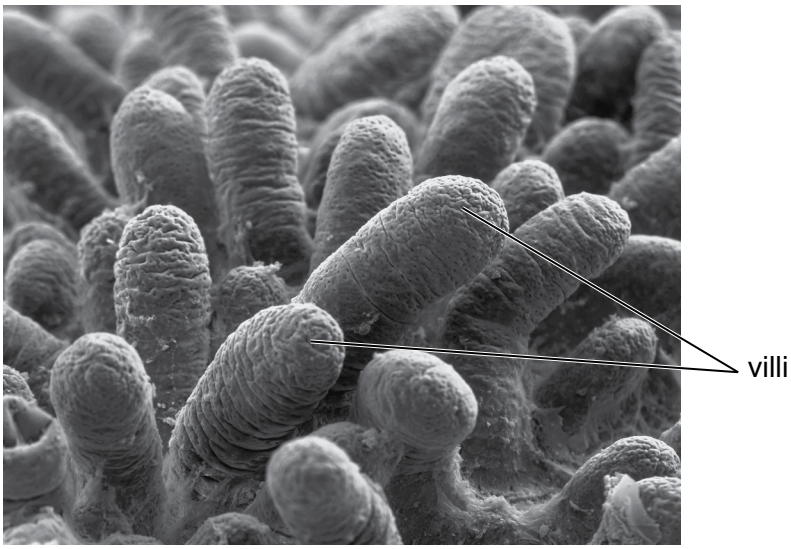

Fig. 1.1

(i) State the function of villi.

.....

..... [1]

(ii) Describe the structure of a villus.

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..... [3]

(b) **(i)** Blood transports nutrients.

State the component of the blood that transports nutrients.

..... [1]

(ii) The nutrients in the blood can be used to become part of cells.

State the name of this process.

..... [1]

(iii) Amino acids are used to make proteins.

State **two** examples of proteins that are found in the blood.

1 .....

2 .....
[2]

(c) Explain the effect of cholera bacteria on the digestive system.

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..... [4]

[Total: 12]

2 Insulin is a hormone that regulates the concentration of glucose in the blood.

(a) Describe what is meant by the term hormone.

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..... [3]

(b) Person **A** and person **B** were monitored to see how well they could control their blood glucose concentration.

They did not eat or drink anything other than water for eight hours before the monitoring began. They then drank a glucose solution.

Blood samples were taken at 30-minute intervals.

The blood samples were tested for glucose concentration.

The results are shown in Fig. 2.1.

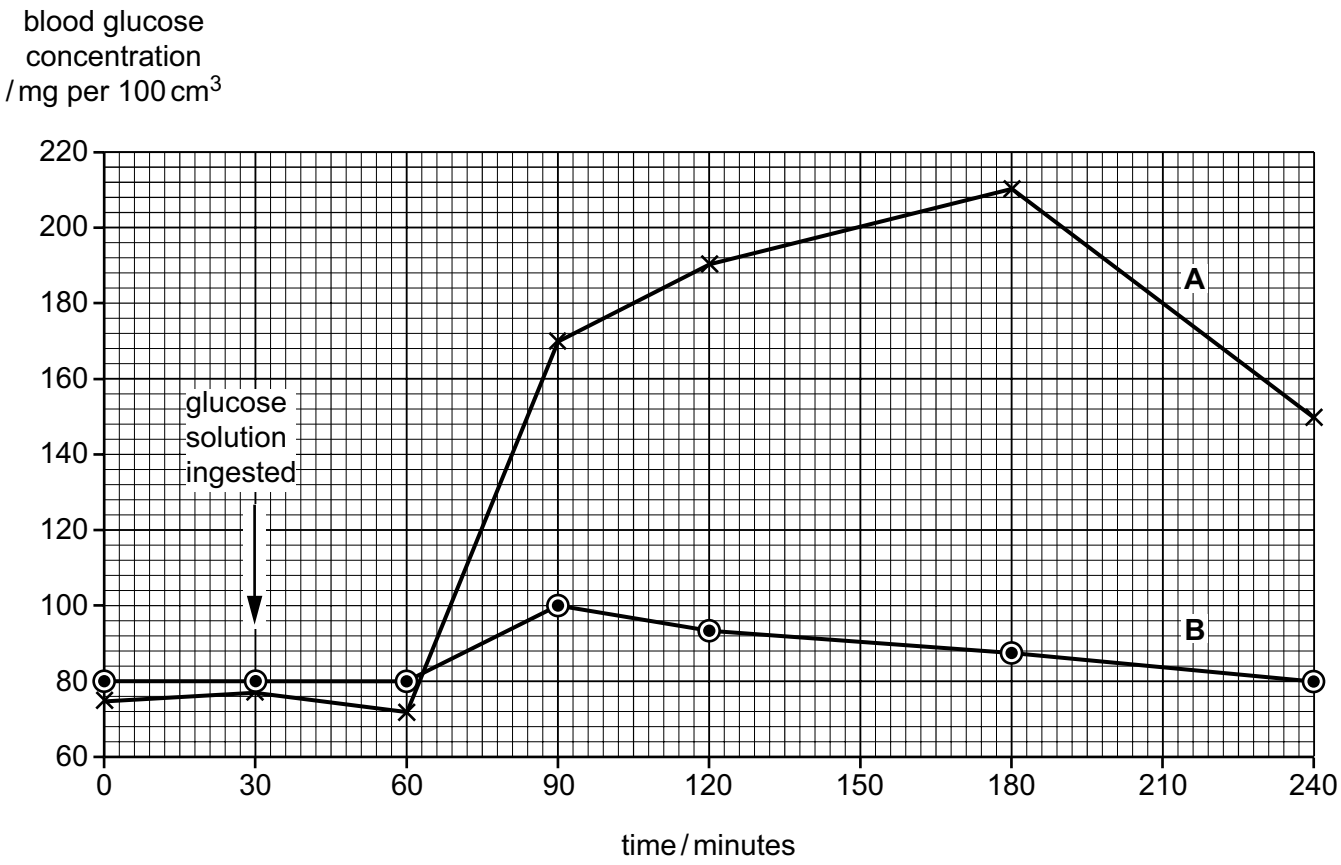

Fig. 2.1

(i) Calculate the percentage increase in the blood glucose concentration in person **A** between 60 and 90 minutes.

Give your answer to the nearest whole number.

.....%
[3]

(ii) Using Fig. 2.1, compare the response of person **A** with the response of person **B** after the ingestion of glucose.

.....

.....

.....

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..... [3]

(iii) Using Fig. 2.1, explain the response of person **B** after 90 minutes.

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..... [4]

(iv) Person **A** had Type 1 diabetes.

Outline the treatment of Type 1 diabetes.

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.....

.....

..... [2]

[Total: 15]

3 Fig. 3.1 shows a photomicrograph of human blood.

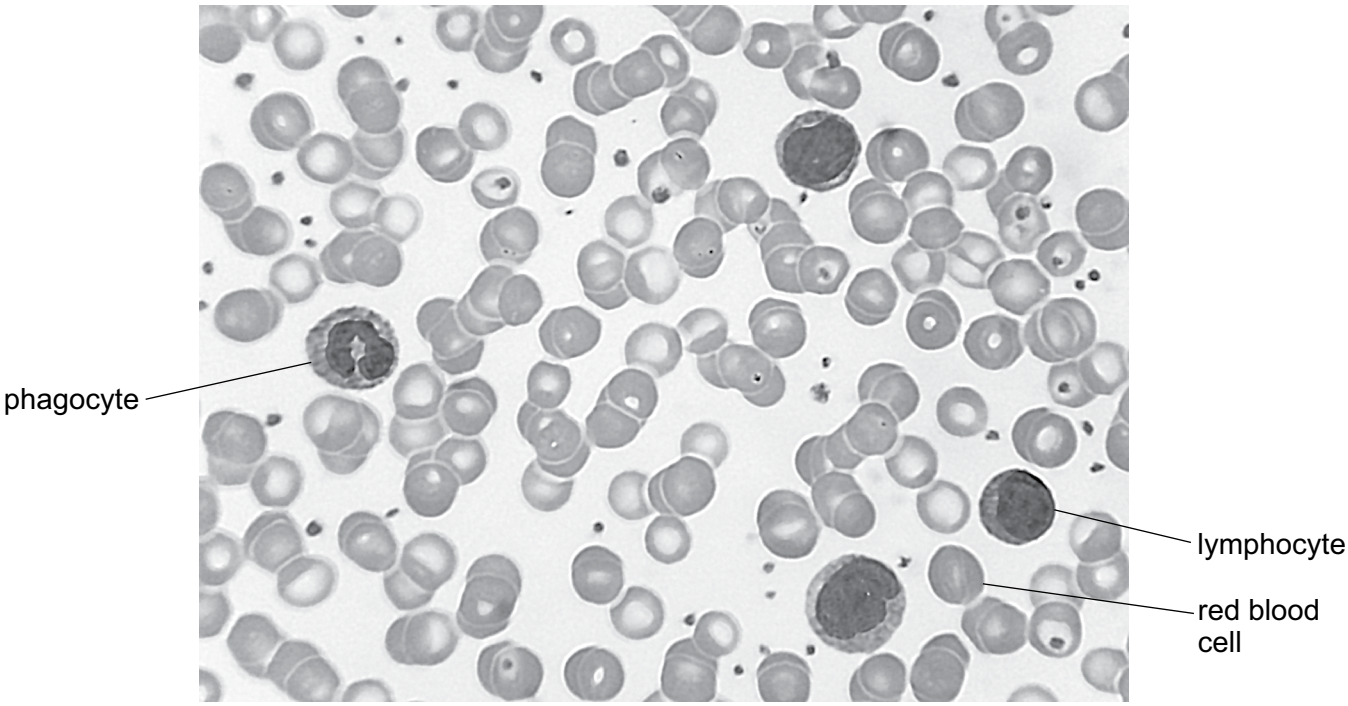

Fig. 3.1

(a) Describe the differences in appearance and the functions of the **three** cells labelled in Fig. 3.1.

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.....

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..... [6]

(b) Fig. 3.2 shows some of the stages of blood clotting.

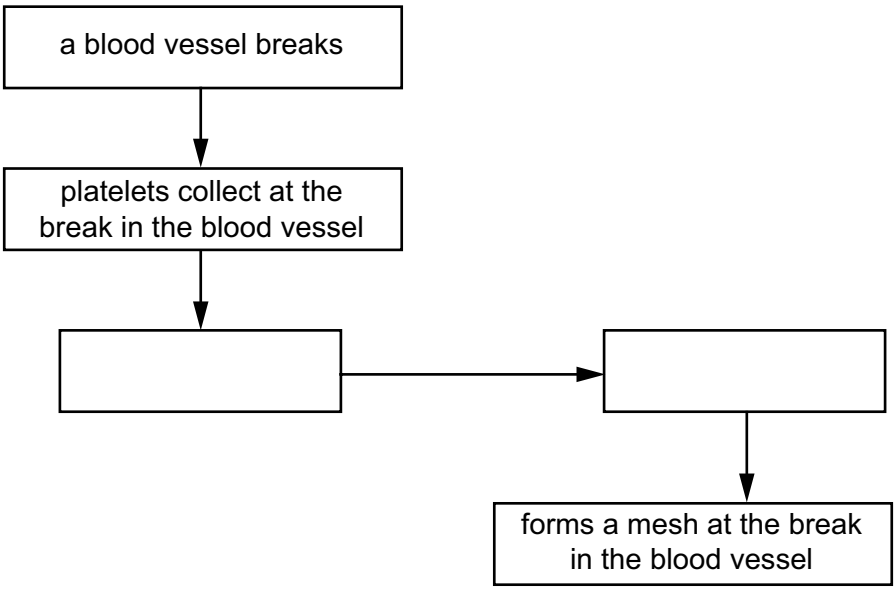


Fig. 3.2

(i) Complete Fig. 3.2 by filling in the **two** empty boxes. [1]

(ii) State **two** roles of blood clotting.

1 .....

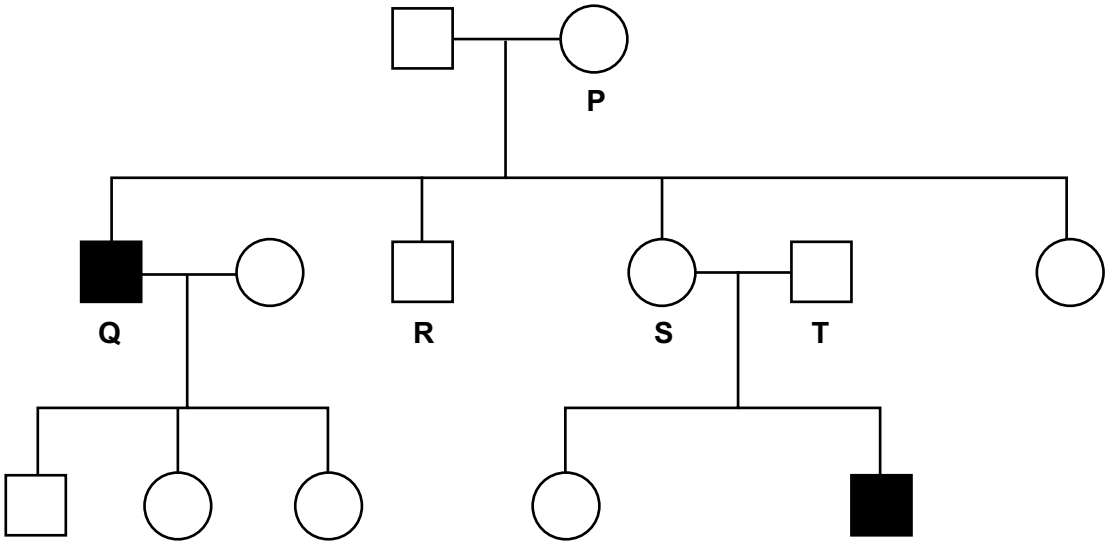
.....

2 .....

.....
[2]

(c) Haemophilia is a sex-linked blood disorder. The blood of people with haemophilia takes longer to clot.

Fig. 3.3 is a pedigree diagram showing the inheritance of haemophilia.



male with normal clotting time

male with haemophilia

female with normal clotting time

Fig. 3.3

- The allele for normal clotting time is represented by $\mathbf{X}^{H}$.
- The allele for haemophilia is represented by $\mathbf{X}^{h}$.

(i) State the genotypes of the people identified as **P**, **Q** and **R** in Fig. 3.3.

P .....

Q .....

R .....

[3]

(ii) The couple **S** and **T** are expecting another child.

State the probability that the child will have haemophilia.

..... [1]

(iii) Describe what is meant by the term sex-linked characteristic.

.....

.....

.....

.....

..... [2]

[Total: 15]

4 **(a)** Yeast can respire aerobically and anaerobically.

State the balanced chemical equation for aerobic respiration.

..... [2]

(b) When yeast respires anaerobically, ethanol is produced.

Ethanol is a type of sustainable resource that can be made from a wide range of crop plants.

It can be used as a biofuel.

Table 4.1 summarises some information about crop plants that are used to make biofuel.

Table 4.1

crop plant	biofuel produced	energy yield / GJ per ha	optimum growth temperature / °C	optimum annual rainfall range / mm
wheat	ethanol	53–84	24	800–1200
corn	ethanol	63–76	18	360–1000
sugar beet	ethanol	110–122	18	360–1000
sugarcane	ethanol	110–140	28	800–1200
oil palm	oil	150–166	28	1100–2500

A country has a mean temperature range of 12 °C to 24 °C. The country has a mean annual rainfall of 1000 mm.

Suggest **and** explain which crop plant would be the **most** suitable crop to grow to produce biofuel in the country.

Use the information in Table 4.1 to support your choice.

crop plant .....

explanation .....

.....

.....

.....

.....

..... [3]

(c) Describe **and** explain how a reduced concentration of water vapour in the air would increase the movement of water through crop plants.

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..... [3]

(d) Sugarcane is a crop plant that is usually grown from stem cuttings rather than from seeds.

Describe the advantages of using cuttings rather than seeds to reproduce crop plants.

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.....

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..... [3]

[Total: 11]

5 Fig. 5.1 shows the marine iguana, *Amblyrhynchus cristatus*.

Fig. 5.1

(a) **(i)** Marine iguanas are reptiles.

State **two** features that are used to classify animals as reptiles.

1 .....

2 .....
[2]

(ii) State **two** structures that are present in plant cells that are **not** present in the cells of reptiles.

1 .....

2 .....
[2]

(b) Marine iguanas feed on seaweed. Seaweed contains starch.

(i) State the names of **two** parts of the digestive system where starch is digested by enzymes.

1 .....

2 .....
[2]

(ii) Explain why the shape of an enzyme is important for digestion.

.....

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..... [3]

(c) There are many threats to species such as the marine iguana.

Describe ways endangered plant and animal species can be conserved.

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..... [5]

[Total: 14]

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6 Wetlands are important ecosystems. Researchers studied the feeding relationships between the organisms in an area of coastal wetland.

Fig. 6.1 shows part of the food web that they studied.

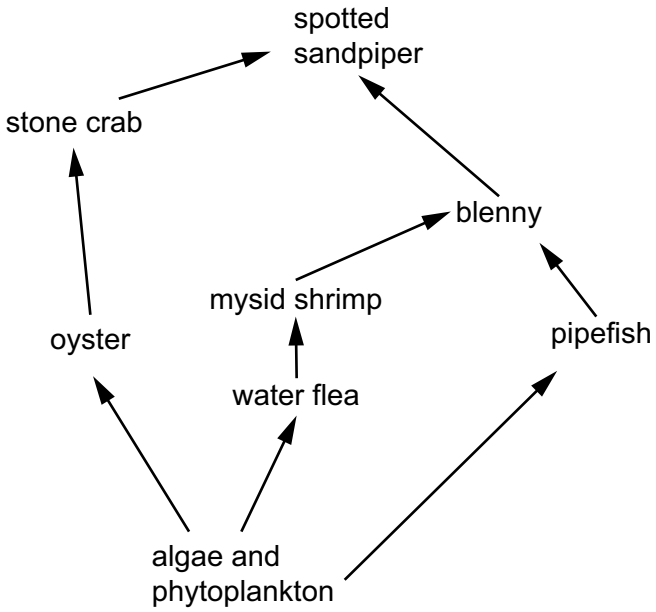

Fig. 6.1

(a) Complete Table 6.1 by giving the name of **one** organism from the food web in Fig. 6.1 for each row.

Table 6.1

	name of organism from Fig. 6.1
producer	
secondary consumer	
an animal that feeds at two trophic levels	

[3]

(b) The functioning of ecosystems relies on the cycling of nutrients.

Fig. 6.2 shows part of the nitrogen cycle.

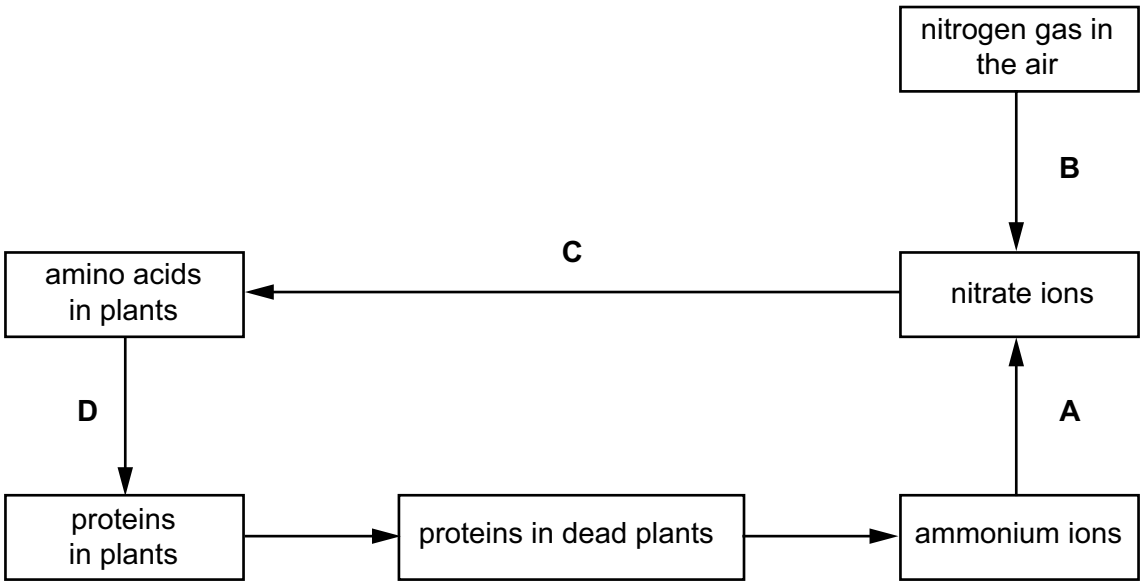

Fig. 6.2

(i) State the name of process **A** in Fig. 6.2 and give the type of organism that converts ammonium ions to nitrate ions.

A .....

type of organism .....
[2]

(ii) Describe how the nitrate ions used in process **C** enter the roots of plants.

.....

.....

.....

.....

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.....

..... [3]

(iii) State the name of the structure in plant cells where process **D** occurs.

..... [1]

(iv) State the process that occurs at **B**.

..... [1]

(c) A pyramid of numbers for the wetland ecosystem showed that there were very large numbers of organisms at the base of the pyramid and very few at the top.

Explain why.

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.....

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.....

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..... [3]

[Total: 13]

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Fig. 3.1 © Ref: C022/5626; DR. FRED HOSSLER, VISUALS UNLIMITED/SCIENCE PHOTO LIBRARY; *Blood smear. Light micrograph showing human blood cells*; www.sciencephoto.com

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