Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

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4578540000

BIOLOGY **0610/42**

Paper 4 Theory (Extended) **October/November 2023**

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 **20** pages. Any blank pages are indicated.

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[Turn over

1 **(a)** Red blood cells are specialised cells that transport oxygen.

State the substance in red blood cells that combines with oxygen.

..... [1]

(b) State the name of the component of blood that promotes blood clotting.

..... [1]

(c) Some students investigated the effect of immersing red blood cells in different concentrations of salt solution.

They measured the diameters of samples of red blood cells and calculated the mean.

They then immersed each red blood cell sample in a different concentration of salt solution.

After two minutes they measured and calculated the mean of the samples again.

Table 1.1 shows the results.

Table 1.1

percentage concentration of the salt solution	mean initial diameter of the red blood cells / μm	mean diameter of the red blood cells after two minutes / μm
0.4	7.5	cells burst
0.8	7.5	8.2
0.9	7.5	7.5
1.8	7.5	6.0

(i) Calculate the percentage increase in the mean diameter of red blood cells that were immersed in the 0.8% salt solution.

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

Space for working.

..... %
[3]

(ii) Explain the results for the red blood cells that were immersed in the 1.8% salt solution.

.....

.....

.....

.....

.....

.....

..... [3]

(iii) State why there was no change in the mean diameter of the red blood cells immersed in the 0.9% salt solution.

.....

.....

..... [1]

(d) State why red blood cells burst when immersed in pure water but plant cells do not.

.....

.....

..... [1]

(e) State **two** uses of water in a plant.

1 .....

2 .....

[2]

[Total: 12]

2 Fig. 2.1 is a photograph of some leaves of a water lily, which is a hydrophyte. The water lily has adaptive features that are found in many different hydrophytes.

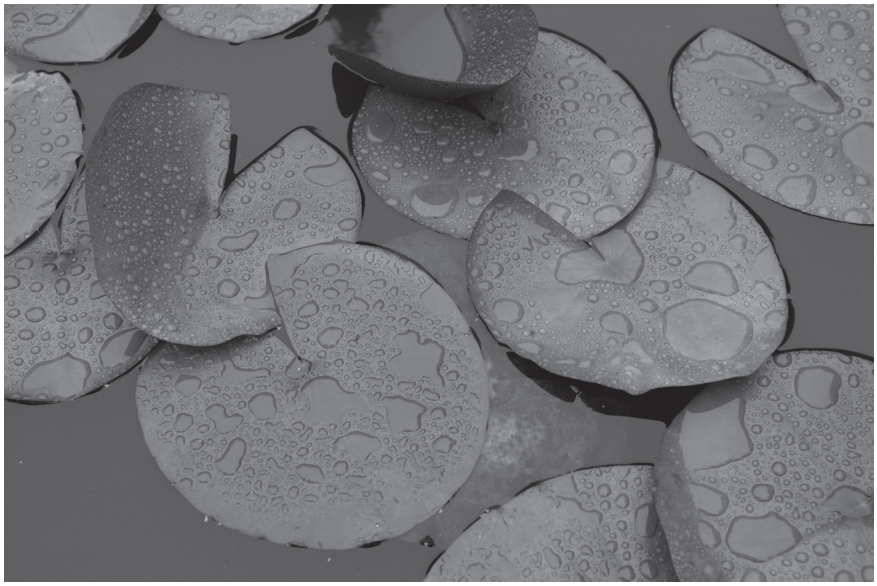


Fig. 2.1

(a) Describe what is meant by an adaptive feature.

.....

.....

.....

.....

..... [2]

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(b) Fig. 2.2 is a photomicrograph of a cross-section of a part of a water lily leaf.

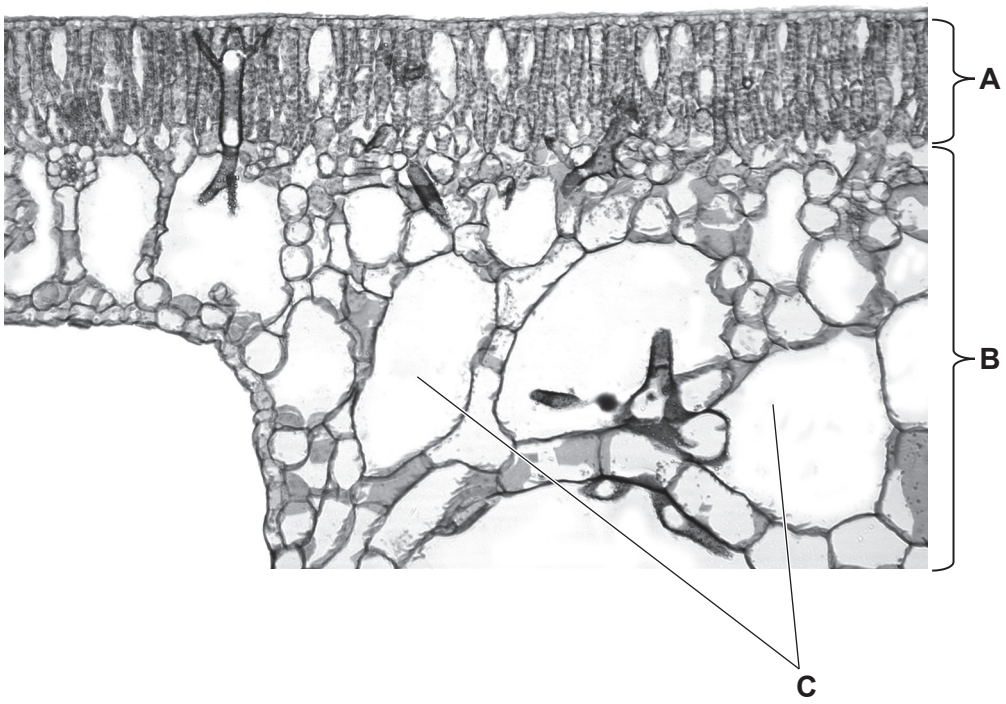


Fig. 2.2

(i) State the names of the parts labelled **A**, **B** and **C** in Fig. 2.2.

A .....

B .....

C .....

[3]

(ii) Explain how part **C** in Fig. 2.2 adapts the hydrophyte for its environment.

.....

.....

.....

.....

.....

.....

..... [3]

(c) A scientist calculated the mean number of stomata per mm^2 in the upper and lower epidermis in tomato plants and water lily plants. Tomato plants are a type of terrestrial plant.

Table 2.1 shows the results.

Table 2.1

	mean number of stomata per mm^2	
plant	in upper epidermis	in lower epidermis
tomato	10	129
water lily	475	0

(i) Compare **and** explain the differences in the mean number of stomata in a tomato plant and in a water lily plant.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

(ii) State the name of the cells that control the opening and closing of stomata.

..... [1]

[Total: 14]

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3 Fig. 3.1 is a diagram of the junction between two neurones in a healthy person.

Fig. 3.2 is a diagram of the junction between the same two neurones in a person who has Parkinson's disease. This disease affects the nervous system.

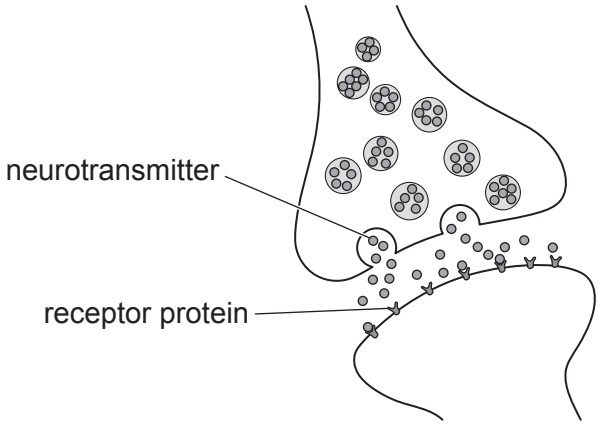


Fig. 3.1

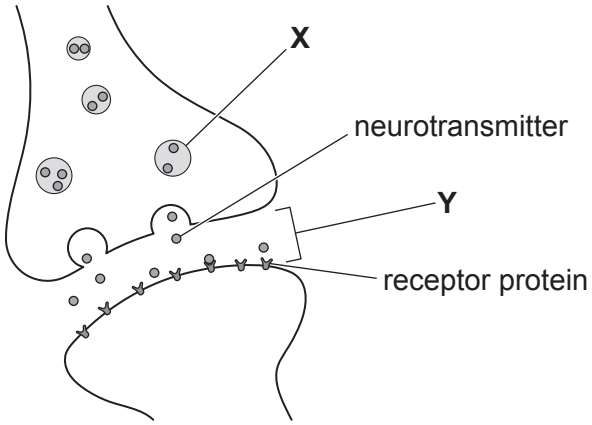


Fig. 3.2

(a) Identify the parts labelled **X** and **Y** in Fig. 3.2.

X .....

Y .....
[2]

(b) Parkinson's disease affects neurones in the brain that are responsible for movement.

Using the information in Fig. 3.1 and Fig. 3.2, suggest **and** explain the effect of Parkinson's disease on a person's movement.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....
[5]

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(c) Describe **two** ways nervous control differs from hormonal control.

1 .....

.....

2 .....

.....

[2]

(d) **(i)** The shape of the receptor proteins shown in Fig. 3.1 and Fig. 3.2 is important for their function.

Explain how the shape of the receptor proteins is determined.

.....

.....

.....

.....

..... [2]

(ii) Cell membranes also contain protein carriers. Describe the role of protein carriers.

.....

.....

.....

.....

..... [2]

[Total: 13]

4 A scientist investigated the effect of temperature on the rate of photosynthesis in one species of plant.

Photosynthesis involves enzyme-controlled reactions.

Discs were cut from a leaf and kept at different temperatures.

The total surface area of the discs was kept the same for each temperature.

The volume of oxygen that was produced by the leaf discs was measured and used to estimate the rate of photosynthesis.

The results are shown in Fig. 4.1.

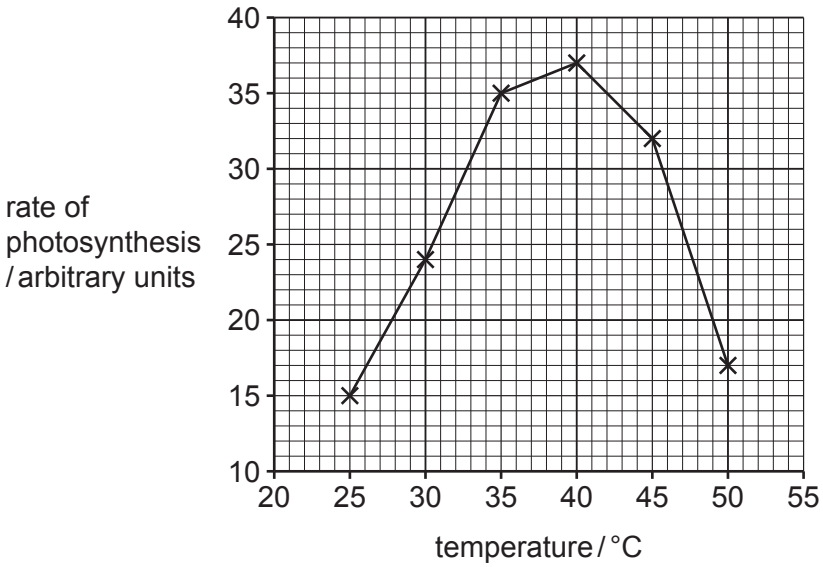


Fig. 4.1

(a) Identify the optimum temperature for photosynthesis in Fig. 4.1.

..... °C [1]

(b) Explain the results shown in Fig. 4.1.

.....

.....

.....

.....

.....

.....

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.....

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.....

.....

..... [6]

(c) Carbon dioxide was supplied in excess at each temperature during the investigation.

Explain why.

.....

.....

.....

.....

..... [2]

(d) Suggest why not all of the oxygen produced by the leaf is released.

.....

.....

..... [1]

(e) Describe the role of chlorophyll in photosynthesis.

.....

.....

.....

.....

..... [2]

[Total: 12]

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5 **(a)** Describe **two** ways in which the circulatory system of a fish is different from the circulatory system of a mammal.

1 .....

.....

2 .....

.....

[2]

(b) Explain the advantages of a double circulatory system.

.....

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.....

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.....

.....

..... [3]

(c) Fig. 5.1 shows part of the circulatory system of a mammal.

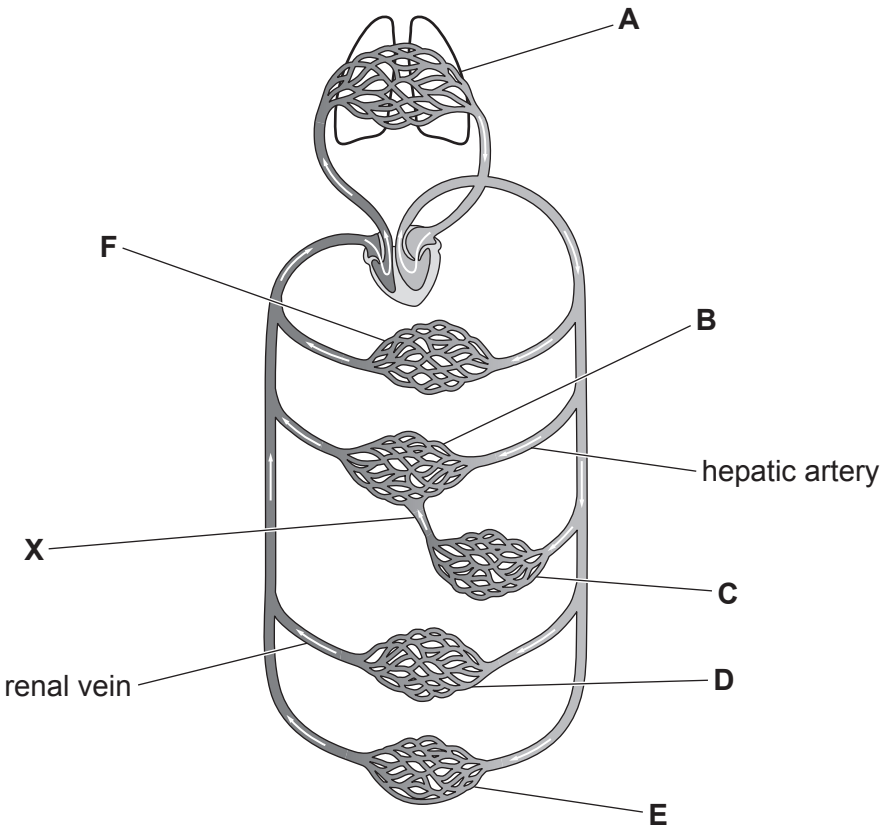


Fig. 5.1

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(i) State the letter from Fig. 5.1 that identifies where these processes occur:

absorption of the products of digestion into the blood .....

excretion of carbon dioxide from the body .....

formation of urine .....

production of bile. .....

[4]

(ii) Identify the name of the blood vessel labelled **X** in Fig. 5.1.

..... [1]

(d) Describe the role of the liver in excretion.

.....

.....

.....

.....

.....

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.....

.....

..... [4]

[Total: 14]

6 **(a)** State the names of **two** hormones released by the ovaries.

1 .....

2 .....
[2]

(b) During pregnancy, antibodies are acquired by the fetus from the mother.

State the organ the antibodies cross to reach the fetus.

..... [1]

(c) A baby was breastfed for six months. The concentration of antibodies in the baby's blood obtained from breast milk and the concentration of antibodies made by the baby itself were measured.

Fig. 6.1 shows the results.

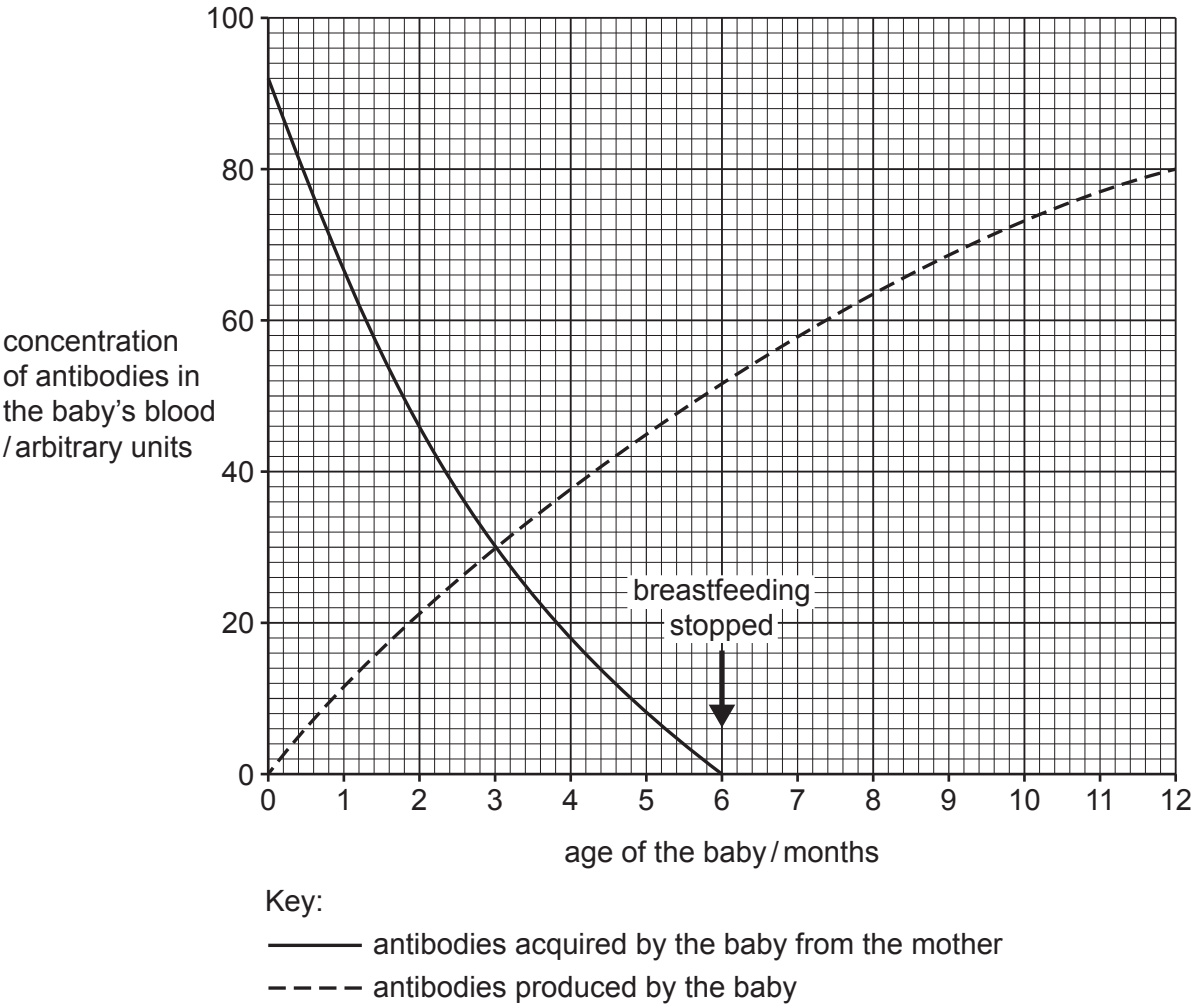


Fig. 6.1

(i) Complete the sentences to describe the changes in antibody concentration in the baby.

After birth the concentration of antibodies acquired from the mother decreases rapidly to 0 arbitrary units at ..... months.

Antibodies start being produced by cells called ..... in the baby immediately after birth.

The total concentration of antibodies in the baby from both sources is ..... arbitrary units at 4 months.

The concentration of antibodies acquired from the mother and the concentration of antibodies produced by the baby are the same at ..... months. [4]

(ii) Describe the benefits of breastfeeding a baby for the first six months of life.

.....

.....

.....

.....

..... [2]

(iii) State **two** ways, other than breastfeeding, that a baby can acquire immunity.

1 .....

.....

2 .....

..... [2]

(d) Explain the importance of the shape of an antibody.

.....

.....

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..... [3]

(e) Antibodies are proteins.

State the chemical elements present in all proteins that are also found in carbohydrates and fats.

..... [1]

[Total: 15]

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