Cambridge Assessment International Education

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BIOLOGY **0610/43**

Paper 4 Theory (Extended) **May/June 2024**

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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1 Fig. 1.1 is a diagram of an animal cell.

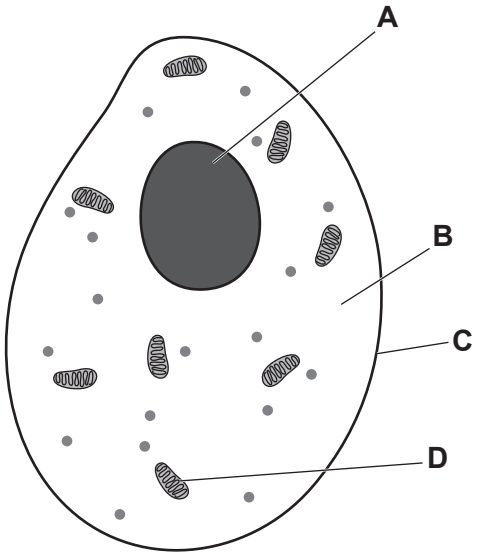

Fig. 1.1

(a) Complete Table 1.1 by writing the name and function of each of the labelled parts of the cell shown in Fig. 1.1.

View solution

Table 1.1

label in Fig. 1.1	name	function
A		
B		
C		
D		

[4]

(b) (i) Explain how water moves into and out of animal cells.

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..... [3]

(ii) A sample of red blood cells was taken from a person. The red blood cells were put into three test-tubes. Each test-tube contained a different liquid:

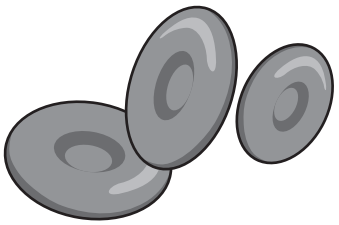
View solution

- blood plasma
- pure water
- a very concentrated salt solution.

Fig. 1.2 shows the appearance of the red blood cells when examined using a microscope.

Identify the liquids the red blood cells were immersed in.

Write your answers in the spaces provided in Fig. 1.2.



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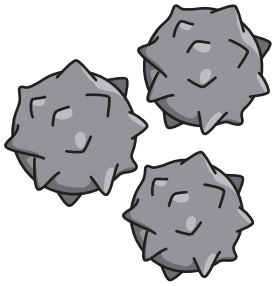

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Fig. 1.2

[2]

(iii) State the name of the molecule in red blood cells that combines with oxygen.

..... [1]

(iv) Fig. 1.3 shows a drawing of a white blood cell.

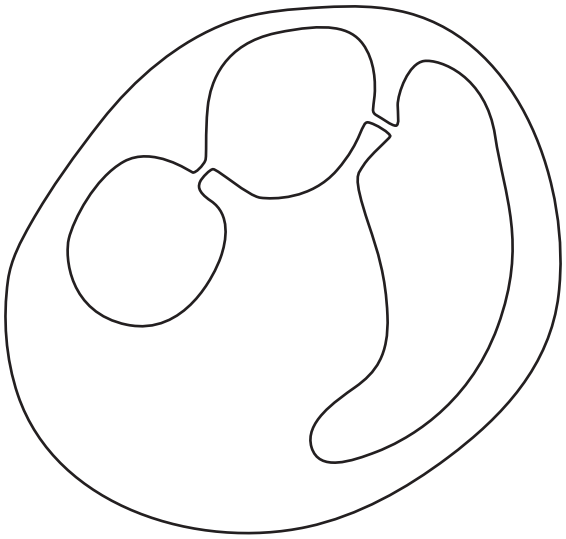

Fig. 1.3

Identify the type of white blood cell shown in Fig. 1.3.

..... [1]

[Total: 11]

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2 Fig. 2.1 is a photograph of a spider plant, *Chlorophytum comosum*. Spider plants can reproduce by producing an identical plantlet, which grows away from the single parent plant.

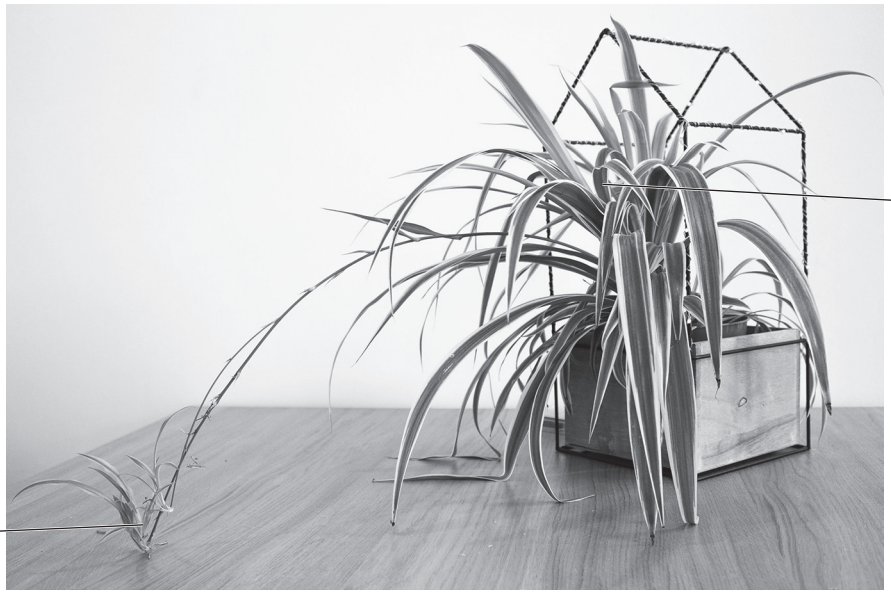

Fig. 2.1

(a) (i) Identify **one** feature in Fig. 2.1 that shows that spider plants are monocotyledons.

View solution

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..... [1]

(ii) Describe the advantages and disadvantages of asexual reproduction in a population of spider plants in the wild.

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..... [4]

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(b) Fig. 2.2 shows pollen that has been released from the flowers of a hazel tree, *Corylus avellana*. These flowers are wind-pollinated.

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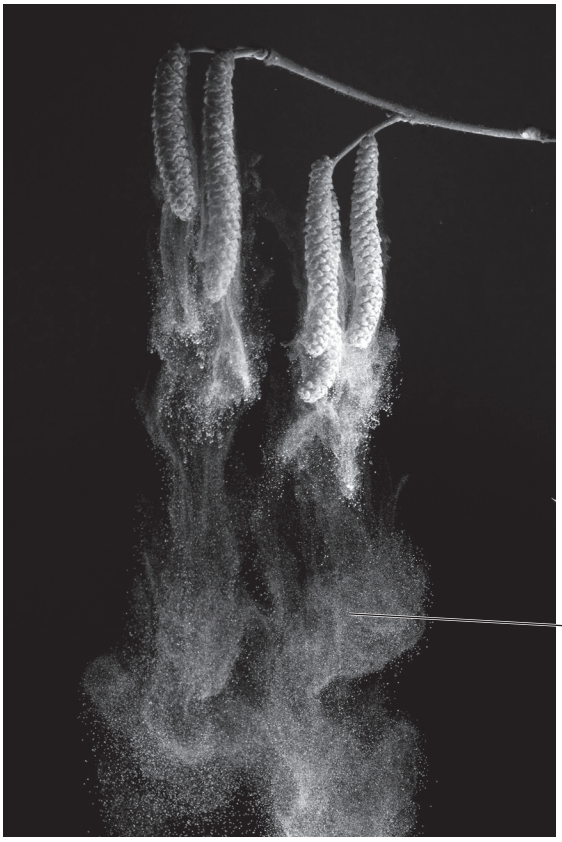

Fig. 2.2

(i) Explain why a hazel tree has to produce very large amounts of pollen.

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..... [1]

(ii) Describe how a stigma from a wind-pollinated plant is adapted for pollination.

View solution

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..... [1]

(c) The hazel tree uses cross-pollination rather than self-pollination.

View solution

Describe cross-pollination.

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..... [2]

(d) Outline the events that occur in the flower after pollination.

View solution

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..... [4]

[Total: 13]

3 **(a)** Proteins are biological molecules.

View solution

Explain how proteins are made.

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..... [6]

(b) Fig. 3.1 is a diagram of enzyme **1** catalysing the breakdown of molecule **A** into two smaller molecules, **B** and **C**.

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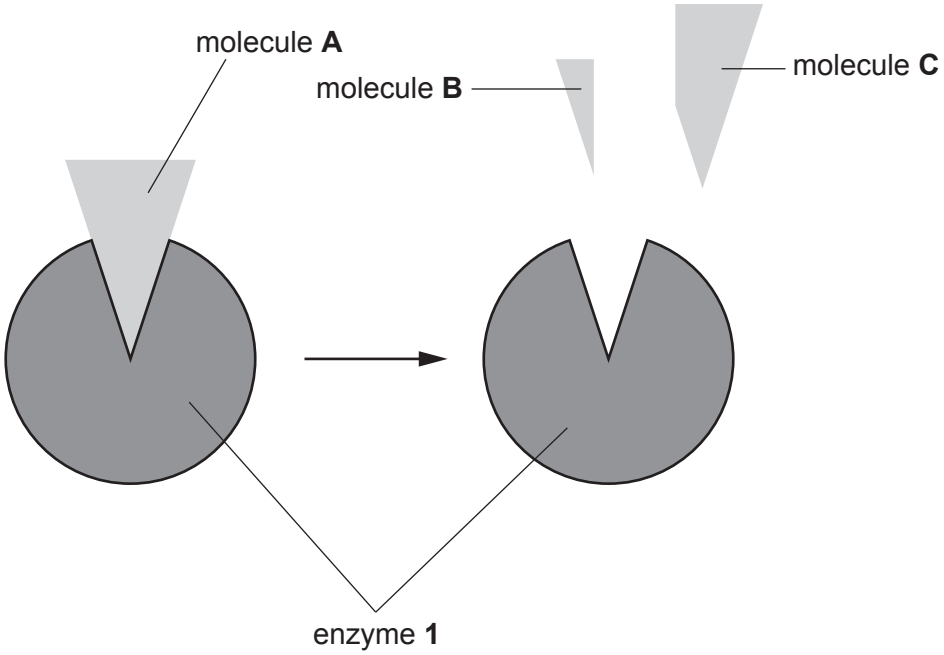

Fig. 3.1

Molecule **D**, shown in Fig. 3.2, is added to the mixture shown in Fig. 3.1.

This causes the rate of production of molecules **B** and **C** to decrease.

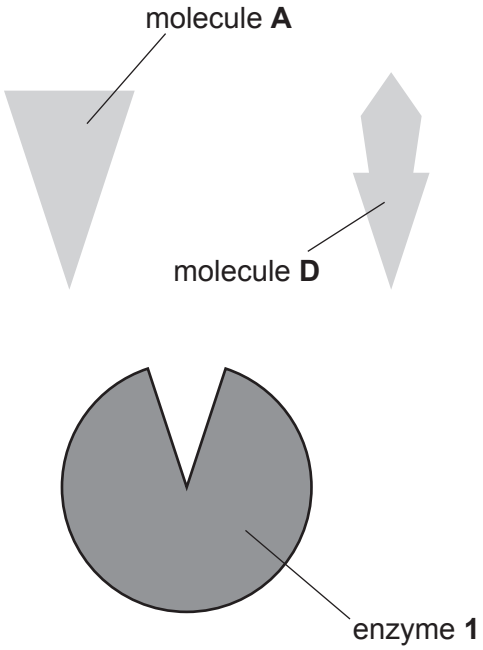

Fig. 3.2

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(i) Using the information in Fig. 3.1 and Fig. 3.2, suggest why the rate of production of molecules **B** and **C** decreases after molecule **D** is added.

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..... [2]

(ii) Fig. 3.3 shows enzyme **1** after a change in its environmental conditions.

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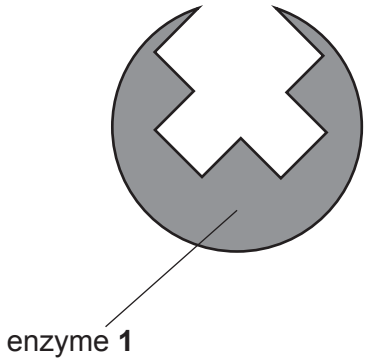

Fig. 3.3

Suggest **two** changes that could cause the effect on enzyme **1** shown in Fig. 3.3.

1 .....

2 .....

[2]

[Total: 10]

4 Characteristics of plants are controlled by genes. Alleles are alternative forms of a gene.

(a) Explain how new alleles are formed.

View solution

.....

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..... [2]

(b) The number of hours of daylight affects when plants produce flowers. This ensures that flowers are produced at an appropriate time of year for each species.

View solution

This response to the number of hours of daylight is controlled by genes.

(i) Wheat is a crop plant. A farmer wants to produce a type of wheat that flowers when there are fewer hours of daylight.

Describe how the farmer could selectively breed this type of wheat.

.....

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..... [3]

(ii) Wheat is grown from seeds.

View solution

State **two** conditions needed for the germination of seeds.

1 .....

2 .....

[2]

(iii) Different types of wheat have also evolved through natural selection.

View solution

Explain how natural selection differs from artificial selection.

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..... [3]

(c) Scientists can selectively breed for increased pest resistance in wheat.

View solution

Explain the benefits of growing wheat with increased pest resistance.

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..... [2]

[Total: 12]

5 Phytoplankton are microorganisms that photosynthesise.

(a) State the chemical equation for photosynthesis.

View solution

..... [2]

(b) A scientist made notes about a marine food web.

View solution

Fig. 5.1 shows the notes she made.

- In the sea, phytoplankton photosynthesise.
- Phytoplankton are eaten by small organisms in the sea, called zooplankton.
- Herring fish and cod fish eat phytoplankton. Herring fish also eat zooplankton.
- Cod fish eat other fish such as herring.

Fig. 5.1

(i) Using the information in Fig. 5.1, complete the food web in Fig. 5.2.

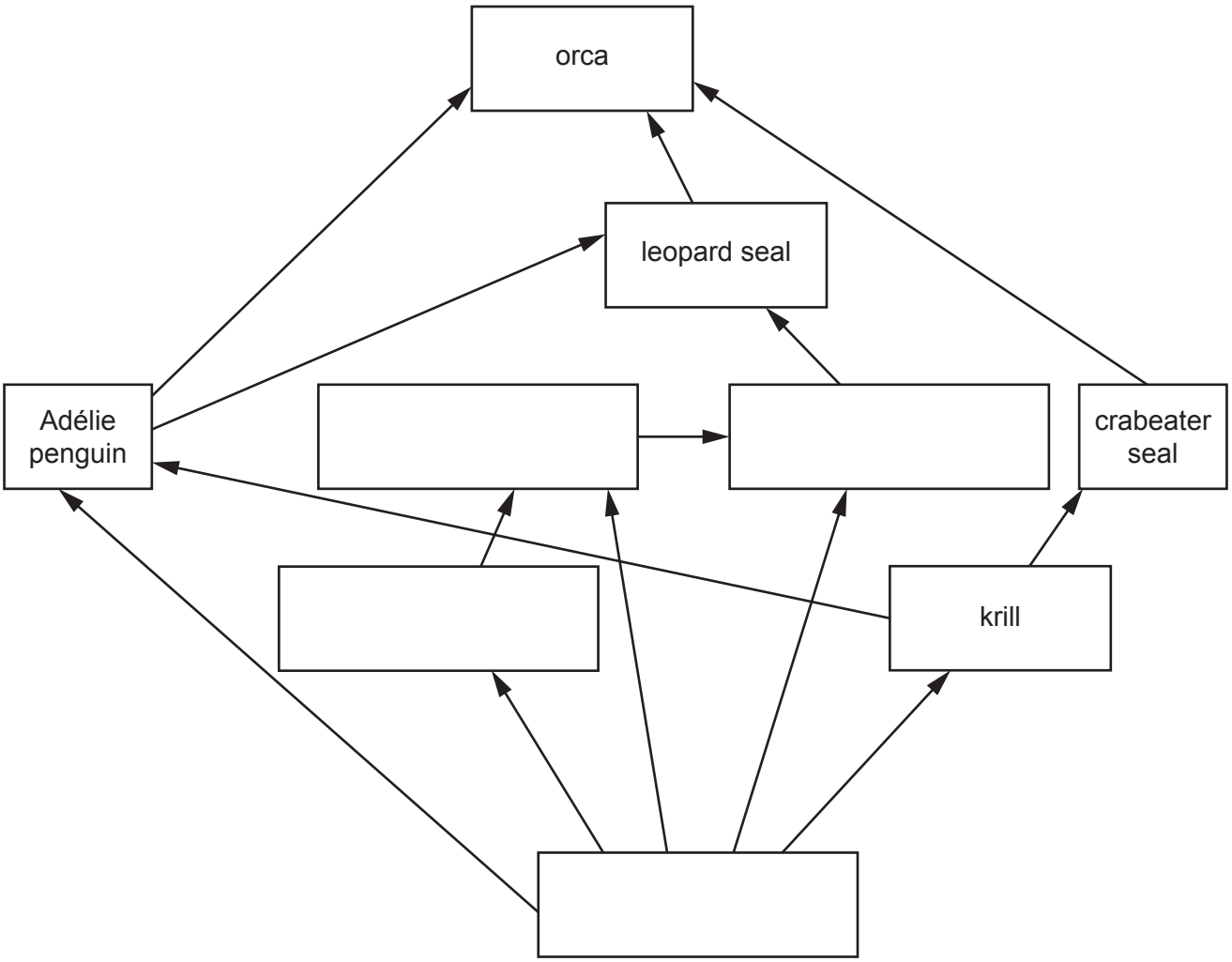

Fig. 5.2

[2]

(ii) State the principal source of energy for this food web.

..... [1]

(iii) Table 5.1 describes features of the food web in Fig. 5.2.

Complete Table 5.1, using the information in Fig. 5.2.

Table 5.1

feature of the food web	maximum number in the food web in Fig. 5.2
trophic levels	
primary consumers	
tertiary consumers	

[3]

(iv) Fig. 5.3 is a photograph of an orca.



Fig. 5.3

Using the information in Fig. 5.2, predict **and** explain the most likely effect of a decrease in the orca population on the population size of:

krill .....

.....

leopard seals. .....

.....

[2]

(c) Krill and seals can be harvested to produce omega-3 fatty acids.

Many people take omega-3 fatty acids as a dietary supplement as they are thought to have health benefits in humans.

View solution

(i) List the chemical elements found in all fats.

..... [1]

(ii) Using the information in Fig. 5.2, explain why it is more energy efficient to use krill as a source of omega-3 fatty acids rather than seals.

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..... [4]

(d) Describe how fats ingested by humans are digested and absorbed.

View solution

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..... [4]

[Total: 19]

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6 Fig. 6.1 shows a boreal toad, *Anaxyrus boreas*. This toad is listed as an endangered species.



Fig. 6.1

View solution

(a) State the genus of the boreal toad.

..... [1]

(b) One reason for the boreal toad's recent decrease in population is a disease caused by chytrid fungus.

State **two** reasons **other than** disease that could cause the boreal toad to become endangered.

1 .....

2 .....
[2]

(c) Scientists investigated whether increasing the number of beneficial bacteria that live on the toads' skin could provide protection against the fungus. The scientists took 42 toads and placed 21 in group **1** and 21 in group **2**.

- Group **1** – the toads' skin was treated with beneficial bacteria.
- Group **2** – the toads' skin was **not** treated with beneficial bacteria.

The scientists measured the number of toads that became infected with the fungus.

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Table 6.1 shows the results.

Table 6.1

time since treatment with beneficial bacteria / days	number of toads with fungal infection	
	group **1**	group **2**
0	0	0
20	2	2
40	3	4
60	9	17
80	13	19
100	13	21

(i) Calculate the percentage of the 21 toads that have the fungal infection after 100 days in group **1** in Table 6.1.

View solution

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

Space for working.

.....%
[3]

(ii) Using the information in Table 6.1, describe the effect of treating the toads with beneficial bacteria.

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..... [2]

View solution

(d) There are conservation programmes to reintroduce boreal toads into their natural habitat.

View solution

(i) Describe why conservation programmes are set up for animals like the boreal toad.

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..... [3]

(ii) Conservation programmes for other endangered animals, such as birds, use artificial insemination as part of a captive breeding programme.

Describe how artificial insemination is carried out as part of a captive breeding programme.

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..... [4]

[Total: 15]

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