Cambridge Assessment International Education

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BIOLOGY **0610/41**

Paper 4 Theory (Extended) **May/June 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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1 **(a)** Fig. 1.1 is a diagram of the digestive system.

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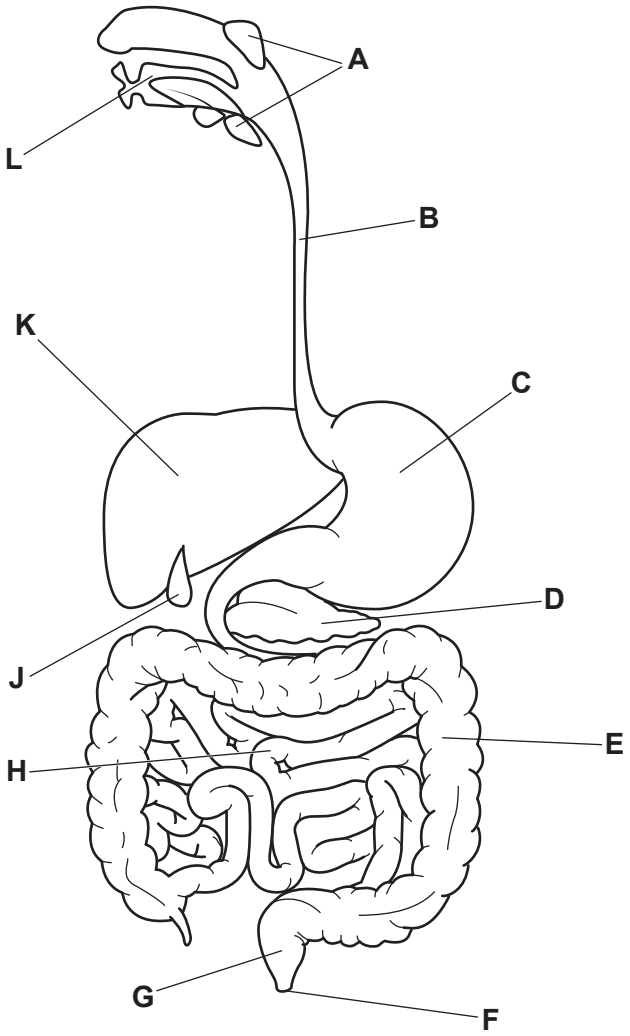

Fig. 1.1

Each letter may be used once, more than once or not at all.

State the letter of the part shown in Fig. 1.1:

that produces bile .....

that produces gastric juice .....

that produces urea .....

where maltose is digested .....

where trypsin acts. .....

[5]

(b) A student investigated the effect of bile on the digestion of fat in milk.

View solution

They set up three different test-tubes:

- test-tube **A** contained milk and bile
- test-tube **B** contained milk and lipase
- test-tube **C** contained milk, lipase and bile.

They used an indicator that is pink in alkaline solutions and colourless in acidic solutions. They added the same volume of indicator to each test-tube.

The student observed and recorded the colour of the contents of each test-tube at 0 minutes, 20 minutes and 40 minutes.

Table 1.1 shows the results of the investigation.

Table 1.1

test-tube	indicator colour observed		
	0 minutes	20 minutes	40 minutes
A	pink	pink	pink
B	pink	pink	colourless
C	pink	colourless	colourless

(i) Explain the results for test-tubes **B** and **C** in Table 1.1.

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..... [4]

(ii) Explain the purpose of test-tube **A** in Table 1.1.

View solution

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..... [2]

(c) The action of lipase is affected by temperature.

View solution

Fig. 1.2 shows the axes for a graph of the effect of temperature on the activity of lipase.

Complete the graph by:

- drawing a line to show the expected effect of temperature on the activity of lipase
- adding a label line and a label to show the point at which all the lipase has been denatured.

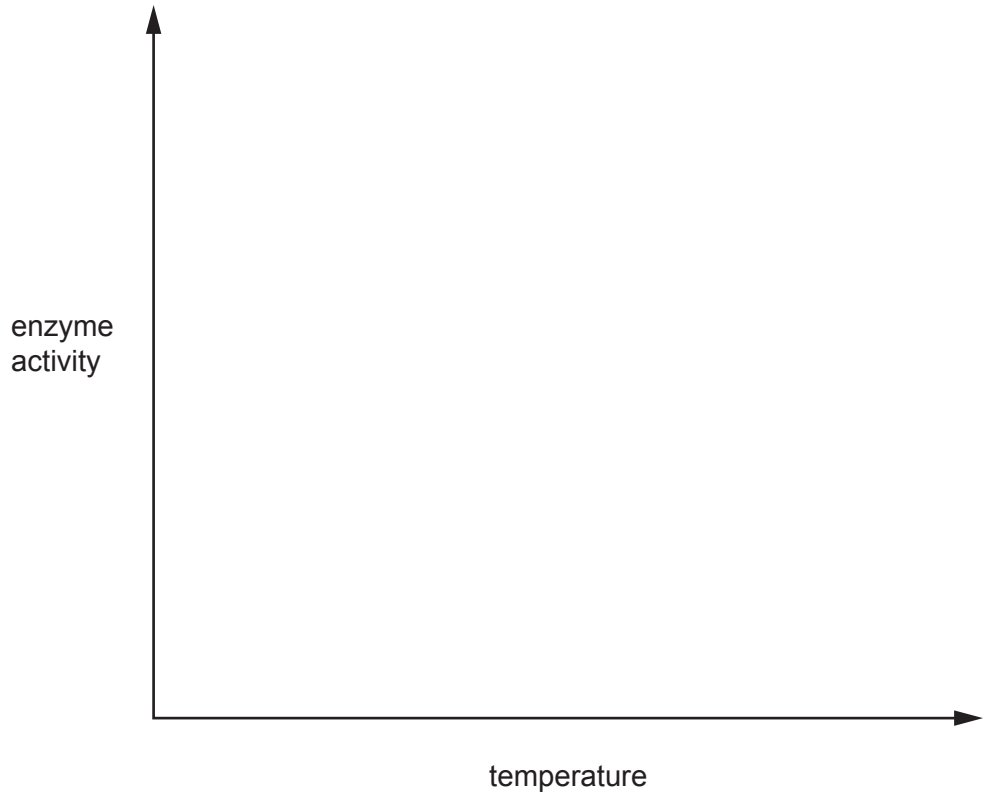

Fig. 1.2

[2]

(d) Explain why lipase cannot be used to catalyse the breakdown of proteins.

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..... [3]

[Total: 16]

View solution

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2 **(a)** A student investigated osmosis in potato plant cells.

He immersed cubes of potato tissue in water and different concentrations of sucrose solution for 30 minutes.

View solution

The masses of the potato cubes were measured before and after immersion.

The percentage changes in mass were calculated.

Table 2.1 shows the results.

Table 2.1

concentration of sucrose solution / mol dm^{-3}	mass of potato cube before immersion / g	mass of potato cube after immersion / g	percentage change in mass
0.00	1.32	1.50	13.64
0.20	1.34	1.49	11.19
0.40	1.30	1.34	3.08
0.60	1.33	1.29	–3.01
0.80	1.22	1.12	–8.20
1.00	1.28	1.11	

(i) Using the information in Table 2.1, calculate the percentage change in mass at 1.00 mol dm^{-3}.

Give your answer to **two** decimal places.

Space for working.

..... %
[3]

(ii) Using the information in Table 2.1, explain the difference in the results between the $0.6\,mol\,dm^{-3}$ and the $0.8\,mol\,dm^{-3}$ sucrose solutions.

Use the term water potential in your answer.

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..... [5]

(iii) Describe the expected appearance of a cell from a potato cube that has been immersed in distilled water for 30 minutes.

.....

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.....

.....

..... [2]

(b) Describe how the process of active transport differs from the process of osmosis.

View solution

.....

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.....

..... [3]

(c) State the type of plant cells that use active transport to absorb mineral ions from the environment.

..... [1]

(d) Explain the effect of a lack of magnesium ions on the colour of plant leaves.

View solution

.....

.....

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..... [2]

[Total: 16]

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3 **(a)** Fig. 3.1 is a photomicrograph of some cells lining the trachea.

View solution

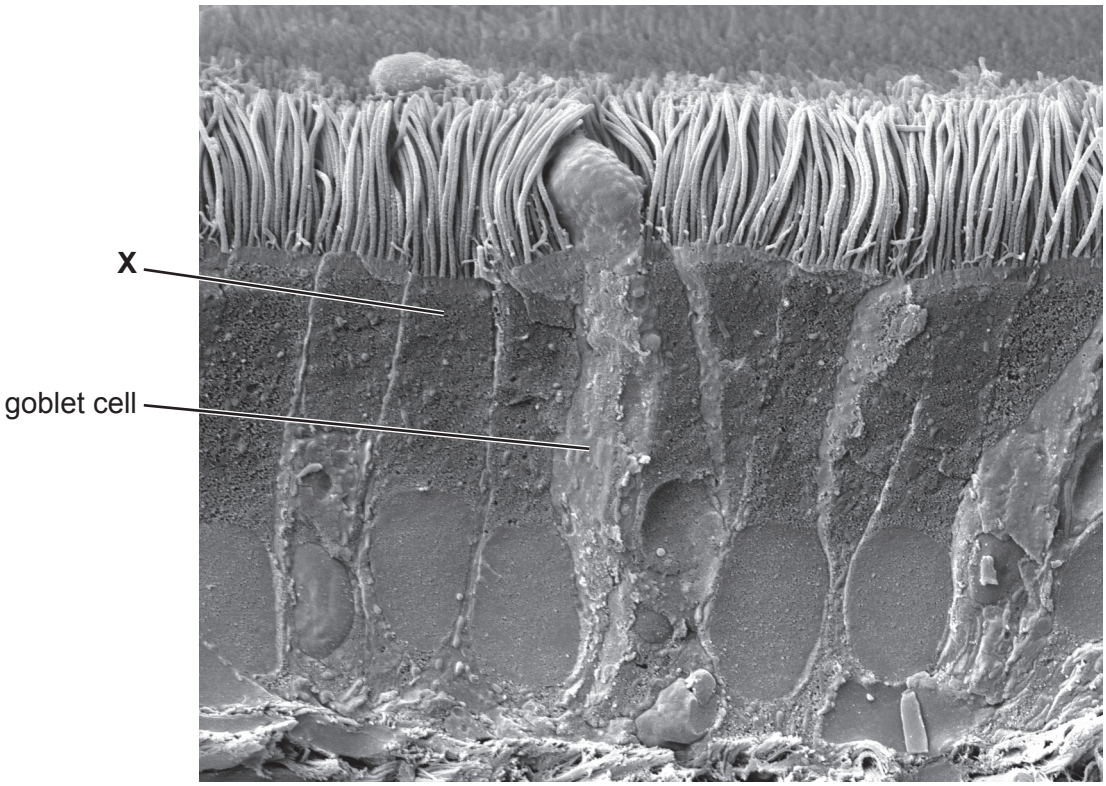

Fig. 3.1

(i) Describe the role of goblet cells.

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..... [2]

(ii) Explain how the cell labelled **X** in Fig. 3.1 is adapted for its function.

.....

.....

.....

.....

..... [2]

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(iii) State the name of **one other** part of the body where the type of cell labelled **X** in Fig. 3.1 is found.

..... [1]

(b) Table 3.1 contains some features of the breathing system.

Complete Table 3.1 to show the actions of each feature of the breathing system that occur to cause inspiration.

View solution

Table 3.1

feature of the breathing system	action that causes inspiration
diaphragm	.....
external intercostal muscles	.....
pressure in the thorax	.....
ribs	.....
volume of the thorax	.....

[5]

(c) State the name of the gas that is excreted by the breathing system.

View solution

..... [1]

(d) Good ventilation is one feature of gas exchange surfaces.

View solution

State **two other** features.

1 .....

2 .....

[2]

(e) State the name of the gas exchange surface in humans.

..... [1]

[Total: 14]

View solution

4 **(a)** Fig. 4.1 shows the effect of light intensity on the rate of photosynthesis at different temperatures and concentrations of carbon dioxide.

View solution

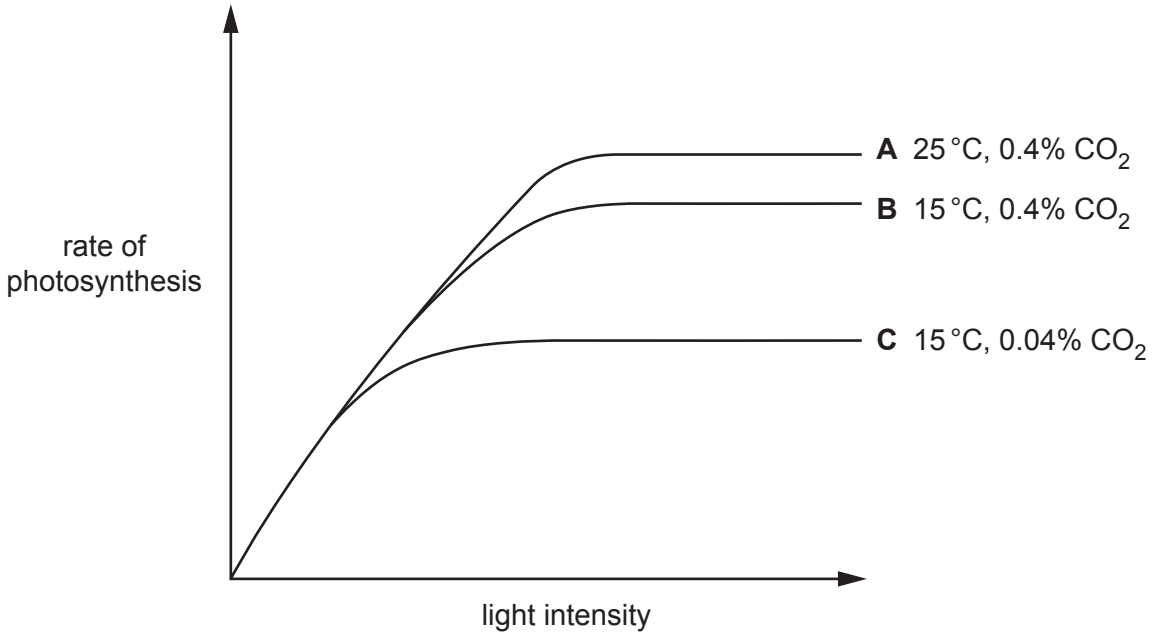

Fig. 4.1

Describe **and** explain the reasons for the shape of lines **B** and **C** in Fig. 4.1.

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..... [6]

(b) $C_6H_{12}O_6$ is one of the products of photosynthesis.

View solution

State the chemical formula of the **other** product.

..... [1]

(c) Outline how the carbohydrates made during photosynthesis are used in plants.

View solution

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..... [4]

[Total: 11]

5 **(a)** Fig. 5.1 shows the stages involved in protein synthesis.

View solution

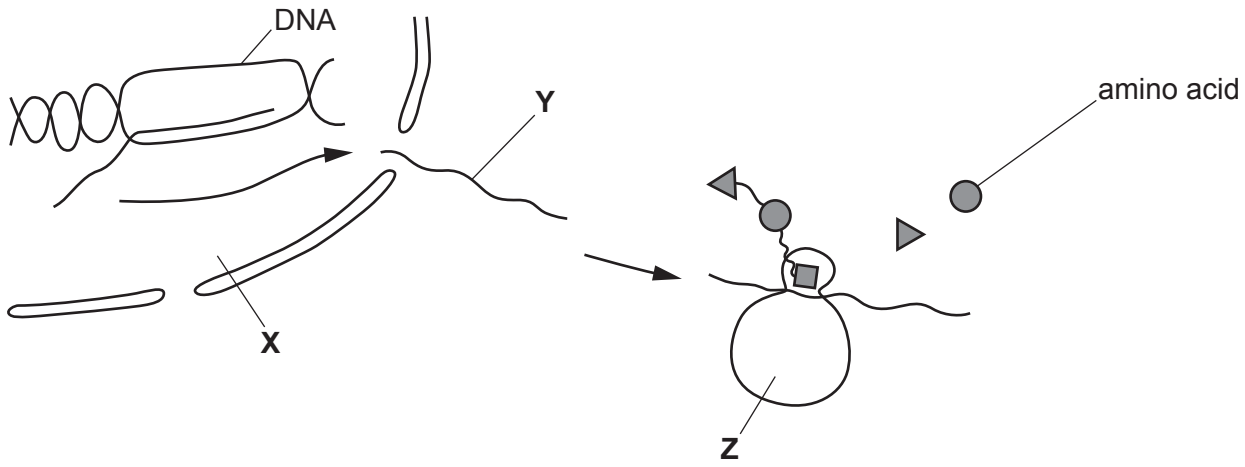

Fig. 5.1

(i) State the names of the parts labelled **X**, **Y** and **Z** in Fig. 5.1.

X .....

Y .....

Z .....
[3]

(ii) State what determines the sequence of the amino acids in the protein that is produced.

.....

.....

..... [1]

(iii) Explain why the sequence of amino acids is important in the production of receptor molecules for neurotransmitters.

.....

.....

.....

.....

..... [2]

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(b) Explain why body cells can have different specialised functions even though they contain the same genes.

.....

.....

.....

.....

..... [2]

(c) Allele frequency in a population can be changed by natural selection and artificial selection.

State the meaning of the term allele.

View solution

.....

..... [1]

(d) Describe how artificial selection differs from natural selection.

View solution

.....

.....

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.....

..... [3]

(e) Mutation causes formation of new alleles which increases genetic variation.

View solution

State **two other** sources of genetic variation in populations.

1 .....

2 .....

[2]

[Total: 14]

6 **(a)** A scientist monitored the changes in the pH in muscles before, during and after two minutes of vigorous exercise.

The changes in pH are caused by the production of lactic acid.

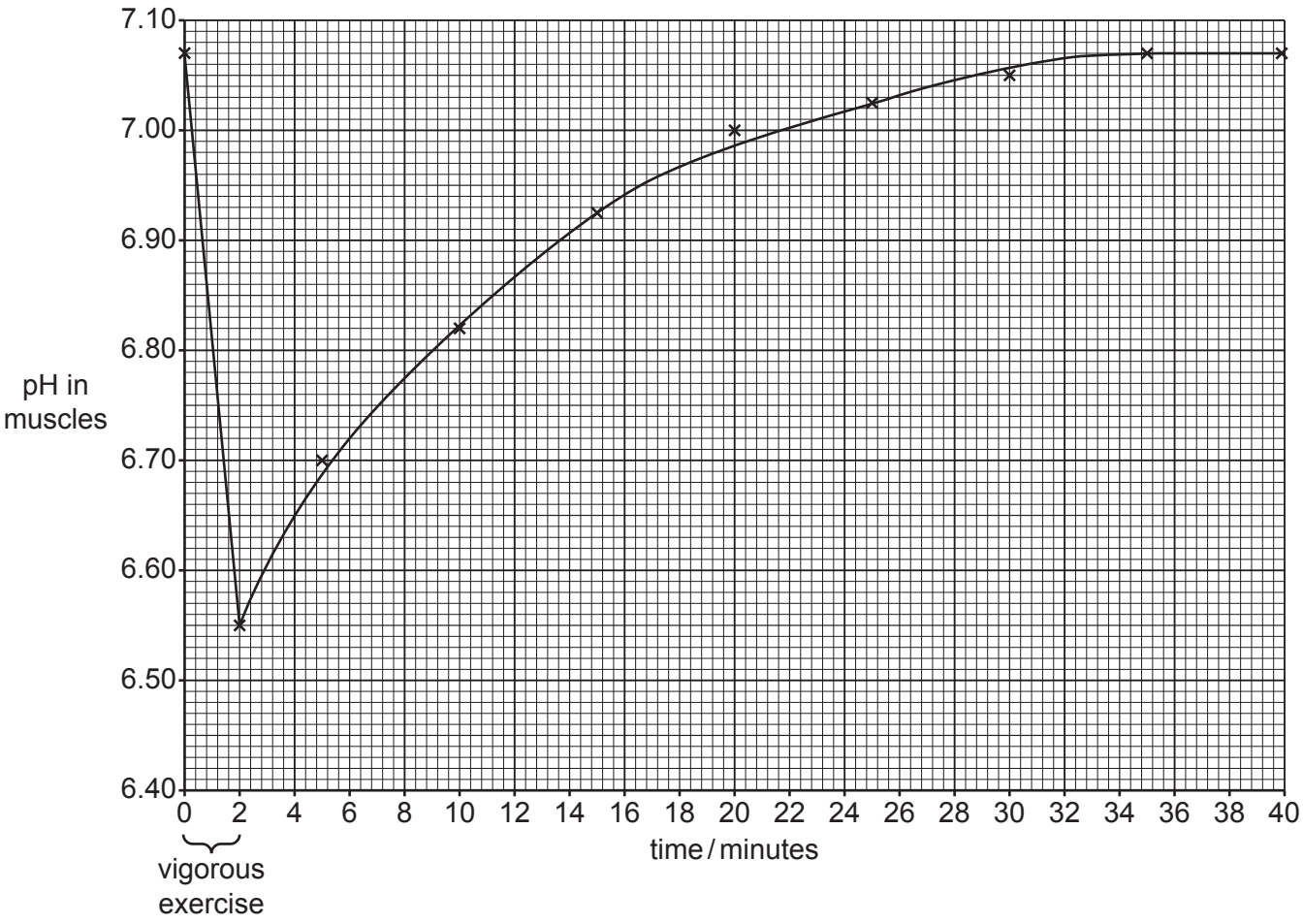

Fig. 6.1

Complete the sentences to describe **and** explain the results in Fig. 6.1.

The pH decreases from ..... to ..... during vigorous exercise.

There is not enough ..... supplied to the muscles.

The body respires anaerobically. The lactic acid produced builds up in the muscles causing

an ..... debt.

It takes ..... minutes for the muscle pH to return to its initial level after exercise.

The pH value increases after vigorous exercise has ended, as lactic acid is transported in the

..... to the ..... .

During this time the breathing rate and ..... rate remain high.

[6]

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(b) Yeast can respire anaerobically.

View solution

(i) Complete the balanced chemical equation for anaerobic respiration in yeast.

$C_6H_{12}O_6$ ..... [2]

(ii) Yeast belongs to the kingdom fungus.

View solution

State **one** cell component that is present in yeast cells but is absent in animal cells.

..... [1]

[Total: 9]

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