AQA GCSE Biology | 8461

SPECIFICATION POINT 4.4.2.1

Aerobic and anaerobic respiration

Past-paper questions

Tier	**Higher**
Question groups	**21**
Available paper years	**2009–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.4.2.1 Aerobic and anaerobic respiration

Question 01

5 Some scientists investigated the rates of absorption of different sugars by the small intestine.

In one experiment they used a piece of normal intestine.
In a second experiment they used a piece of intestine poisoned by cyanide. Cyanide is poisonous because it prevents respiration.

The results are shown in the table.

	Relative rates of absorption	
Sugar	**Normal intestine**	**Intestine poisoned by cyanide**
Glucose	1.00	0.33
Galactose	1.10	0.53
Xylose	0.30	0.31
Arabinose	0.29	0.29

5 (a) (i) Name **two** sugars from the table which can be absorbed by active transport.

1 .....

2 .....

(1 mark)

5 (a) (ii) Use evidence from the table to explain why you chose these sugars.

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(3 marks)

4.4.2.1 Aerobic and anaerobic respiration

Question 01 · continued

for mark

5 (b) All of the sugars named in the table can be absorbed by diffusion.

Explain how information from the table provides evidence for this.

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(2 marks)

6

Turn over for the next question

4.4.2.1 Aerobic and anaerobic respiration

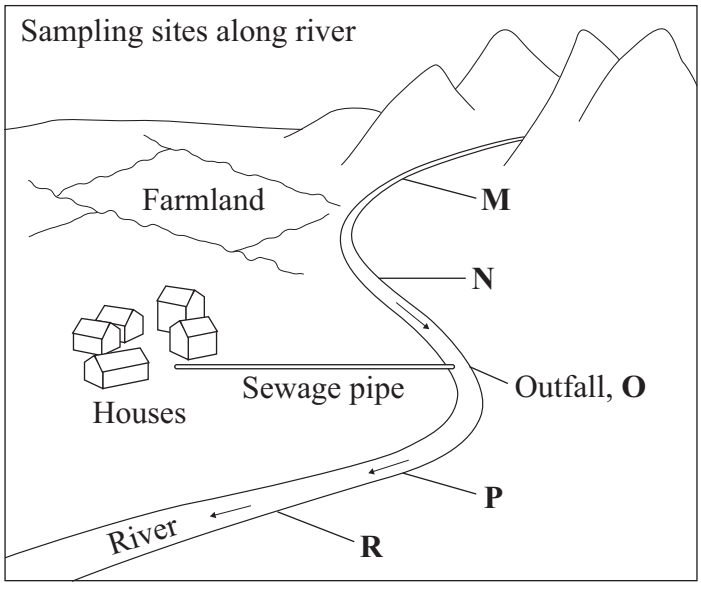
Question 02

March 2010 | BLY1BP | Original Q7 | Legacy

QUESTION SEVEN

Oxygen is used in respiration by organisms. The amount of oxygen in a river can give information about the health of a river.

The oxygen content of a river was measured by scientists at a series of locations, **M** to **R**, including where sewage entered the river.



7A The oxygen meter that the scientists used gave values in whole numbers. The readings at each location were all the same.

The most likely explanation for this is that . . .

1 the meter was not reliable.

2 any differences in the oxygen content were less than the sensitivity of the meter.

3 the oxygen content does not matter to the health of the river.

4 there was no difference in the oxygen content of the water at the different locations.

7B A different type of oxygen meter was then used.

The oxygen content of the river just below the sewage outfall was found to be lower than that above the outfall.

The most likely reason for this is that . . .

1 the river was running faster just below the sewage outfall.

2 less oxygen was dissolving from the air just below the sewage outfall.

3 dissolved oxygen was used up for respiration by microorganisms from the sewage.

4 toxic chemicals from the sewage outfall were polluting the river.

4.4.2.1 Aerobic and anaerobic respiration

Question 02 · continued March 2010 | BLY1BP | Original Q7 | Legacy

There was a change in the species of animal that lived in the river further downstream past the sewage outfall.

The table shows the relative numbers of each type of organism from each sampling point along the river.

	Upstream		Sewage outfall	Downstream	
Sample position along river	**M**	**N**	**O**	**P**	**R**
Stonefly larvae	5	6	0	0	2
Water snail	20	15	10	12	12
Caddisfly larvae	7	8	1	2	6
Bloodworms	4	3	30	25	12

7C Which organism was found in greatest numbers in water with low oxygen levels?

1 stonefly larvae

2 water snails

3 caddisfly larvae

4 bloodworms

7D In the past year, the concentration of oxygen in the river downstream past the sewage outfall has decreased.

This is most likely to have been caused by . . .

1 a decrease in water temperature all along the river.

2 increased use of toxic chemicals in the surrounding farms that drain into the river.

3 an increase in the human population in the area.

4 fewer fish inhabiting the river.

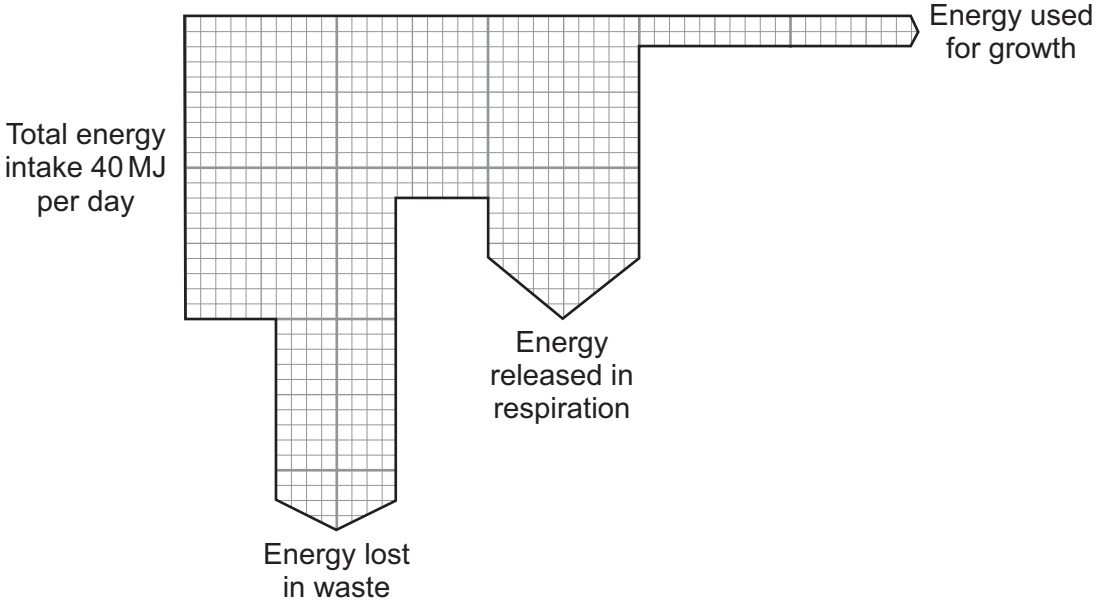
4.4.2.1 Aerobic and anaerobic respiration

Question 03

June 2019 | BLY2H | Original Q2 | Legacy

2 (a) **Diagram 1** represents what happens to the energy in the food eaten by a herbivore (an animal that eats plants).

Diagram 1



2 (a) (i) How much energy is released in respiration by the herbivore?

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Answer ..... MJ per day
(1 mark)

2 (a) (ii) What proportion of the total energy intake of the herbivore is used for growth?

Show clearly how you work out your answer.

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Proportion .....
(2 marks)

2 (b) Give **two** ways in which the energy, released in respiration, is used by a herbivore.

1 .....

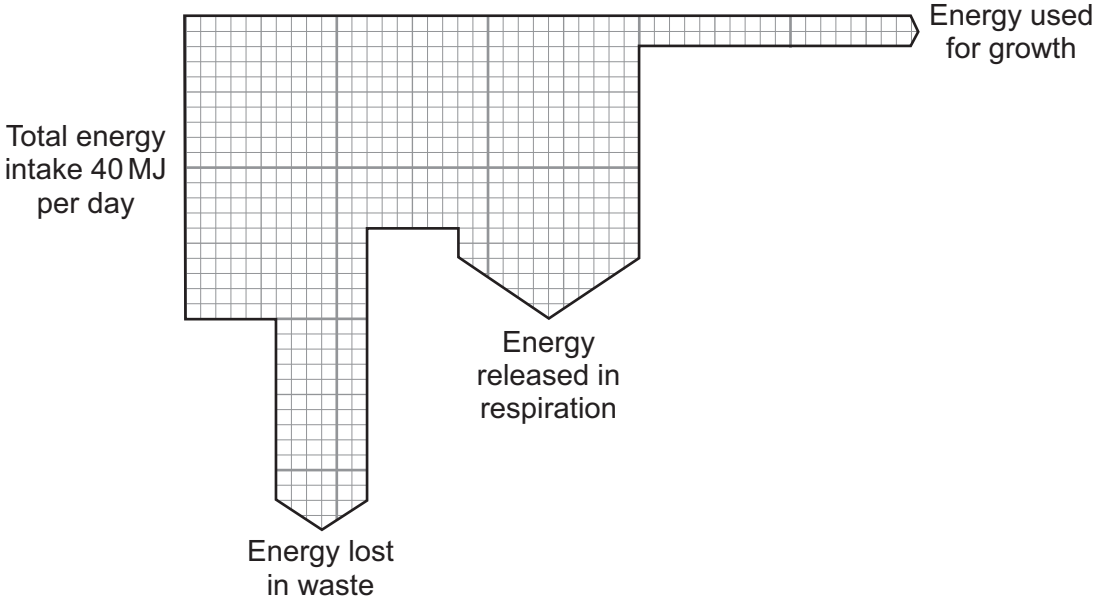
2 .....
(2 marks)

4.4.2.1 Aerobic and anaerobic respiration

Question 03 · continued

2 (c) **Diagram 2** represents what happens to the energy in the food eaten by a carnivore (an animal that eats other animals).

Diagram 2



The carnivore releases a greater proportion of energy in respiration than the herbivore.

Suggest **one** reason for this.

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(1 mark)

2 (d) Some farmers keep their animals outdoors. Other farmers keep their animals indoors.

Keeping farm animals indoors increases the proportion of energy in their food that is converted into growth.

Give **two** reasons why.

1 .....

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2 .....

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(2 marks)

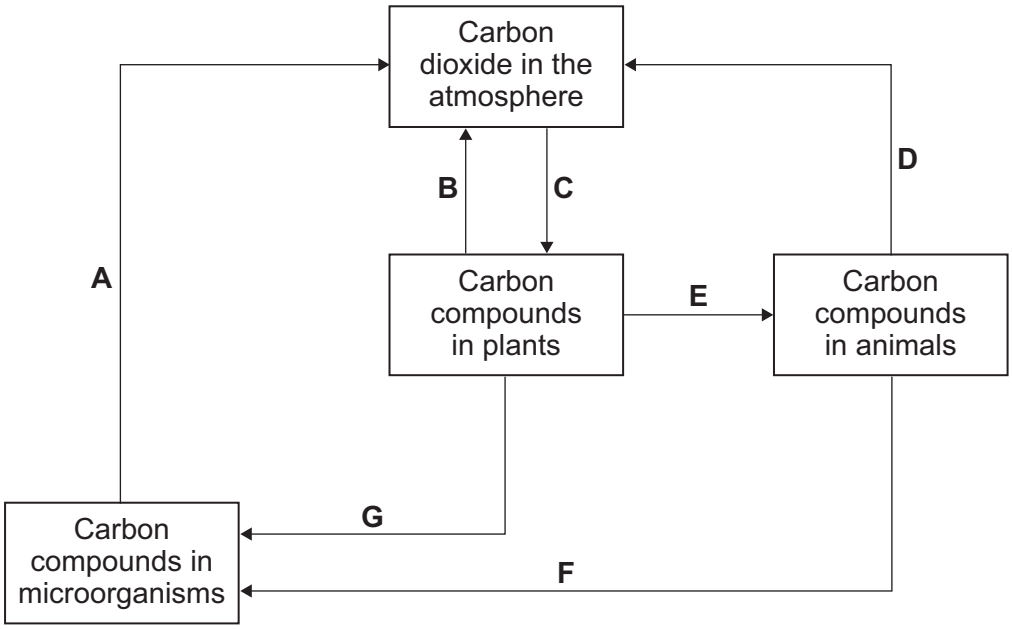
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4.4.2.1 Aerobic and anaerobic respiration

Question 04

June 2010 | BLY2H | Original Q3 | Legacy

3 The diagram shows part of the carbon cycle.



3 (a) Letter **A** represents respiration.

Which **two** other letters represent respiration?

☐ and ☐

(1 mark)

3 (b) Other than carbon dioxide name **two** carbon compounds found in plants.

1 .....

2 .....

(2 marks)

4.4.2.1 Aerobic and anaerobic respiration

Question 04 · continued

3 (c) Gardeners use compost heaps to decay dead plants. Decayed compost is then spread onto the soil in a garden.

Explain why gardeners spread decayed compost onto the soil.

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(2 marks)

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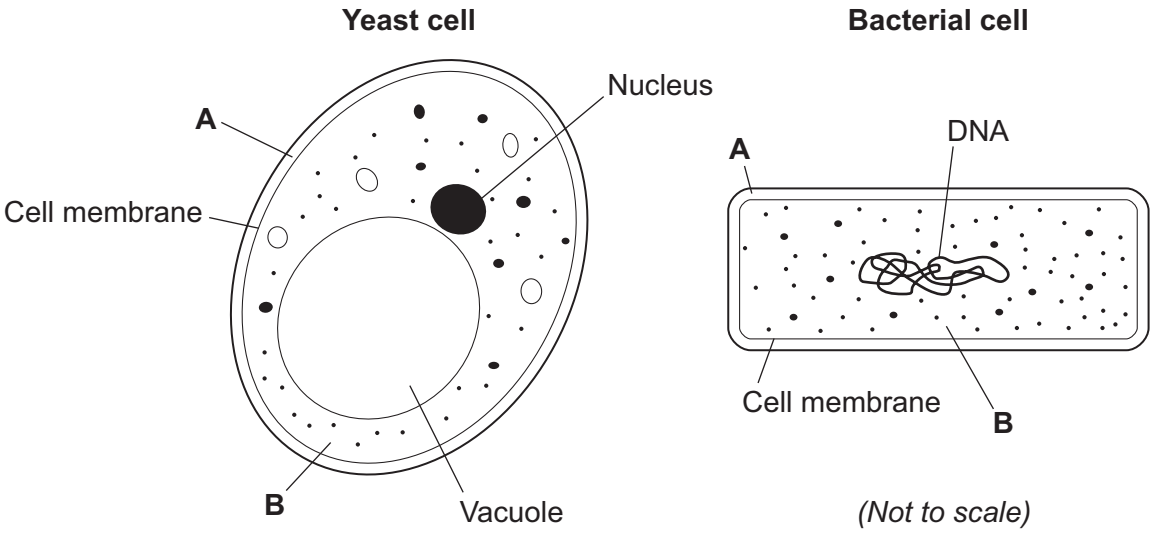
Turn over for the next question

4.4.2.1 Aerobic and anaerobic respiration

Question 05

1 Sourdough bread is light in texture and tastes slightly sour. It is made using two types of microorganism, a yeast and a bacterium. The bacterium can make acids such as lactic acid. This acid makes the bread taste sour.

1 (a) The diagrams show the structures of the yeast cell and the bacterial cell.



1 (a) (i) Both the yeast cell and the bacterial cell have structures **A** and **B**.

Name structures **A** and **B**.

A .....

B .....

(2 marks)

1 (a) (ii) The yeast cell and the bacterial cell have different shapes.

Give **one** other way in which the structure of the bacterial cell is different from the structure of the yeast cell.

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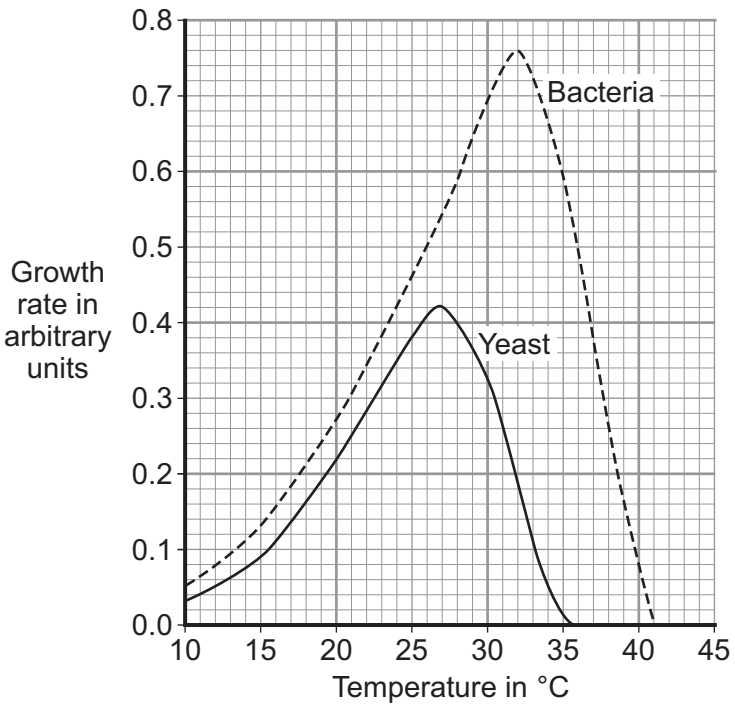
(1 mark)

Question 1 continues on the next page

4.4.2.1 Aerobic and anaerobic respiration

Question 05 · continued

1 (b) The graph shows how the growth rates of the yeast and the bacteria change with temperature.



1 (b) (i) Sourdough bread rises fastest at 27 °C.

Explain why.

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(2 marks)

1 (b) (ii) The bread has a sourer taste if it rises at 32 °C.

Explain why.

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(2 marks)

4.4.2.1 Aerobic and anaerobic respiration

Question 05 · continued

1 (b) (iii) The growth rate of the yeast is unaffected by pH in the range 3.5 to 7.0 pH units.

Why is this useful in the production of sourdough bread?

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(1 mark)

8

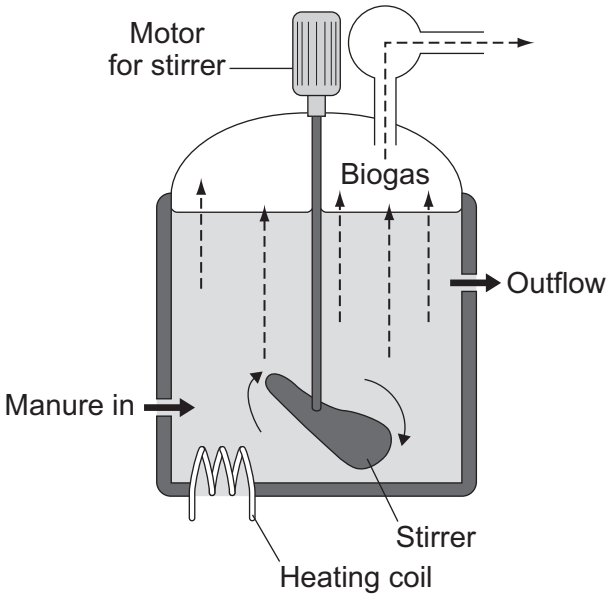
Turn over for the next question

4.4.2.1 Aerobic and anaerobic respiration

Question 06

June 2010 | BLY3H | Original Q3 | Legacy

3 The diagram shows one type of *anaerobic* digester. This is used to produce biogas.



3 (a) (i) What does *anaerobic* mean?

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(1 mark)

3 (a) (ii) The concentration of solids fed into this digester must be kept very low.

Suggest **one** reason why.

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(1 mark)

3 (a) (iii) This digester is more expensive to run than some other simpler designs of biogas generator.

Suggest **one** reason why.

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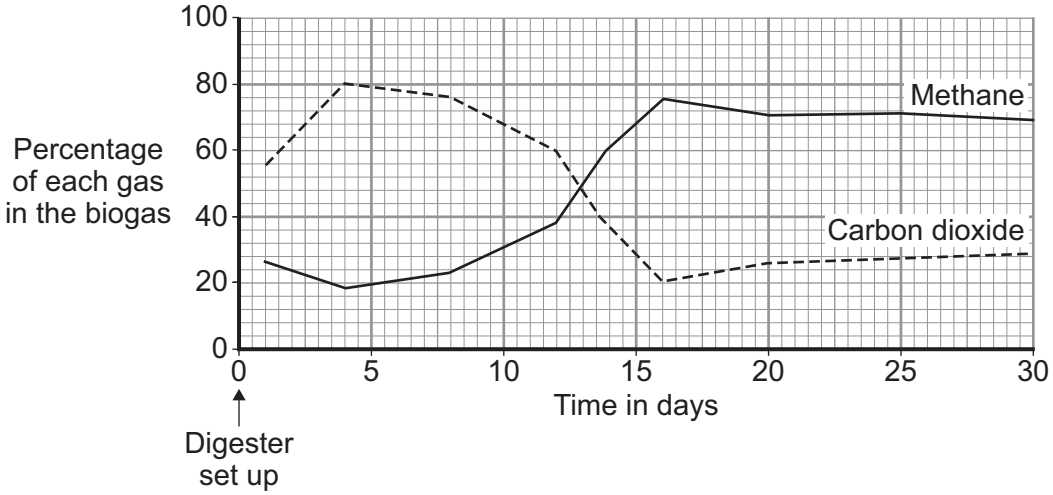
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(1 mark)

4.4.2.1 Aerobic and anaerobic respiration

Question 06 · continued

3 (b) The graph shows how the composition of the biogas produced by the digester changed over the first 30 days after the digester was set up.



Use information from the graph to answer the following questions.

3 (b) (i) Describe how the percentage of carbon dioxide changed over the 30 days.

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(3 marks)

3 (b) (ii) On which day was the best quality biogas produced? .....

(1 mark)

3 (c) Four days after the digester was first set up, the biogas contained a high percentage of carbon dioxide.

Suggest an explanation for this.

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(2 marks)

9

4.4.2.1 Aerobic and anaerobic respiration

Question 07

January 2011 | BLY3H | Original Q4 | Legacy

4 (a) Ethanol can be produced from glucose.
The glucose is often made by the digestion of maize starch.

The equation shows the digestion of starch.

$$\text{starch} + \text{water} \xrightarrow{\text{enzymes}} \text{glucose}$$

4 (a) (i) Name the type of enzyme that can be used to digest starch.

.....

(1 mark)

4 (a) (ii) The glucose can then be used by yeast in the following process.

$$\text{glucose} \xrightarrow{\text{enzymes}} \text{ethanol} + \text{carbon dioxide} (+ \text{energy})$$

Name this process.

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(1 mark)

4 (b) Ethanol, produced as described in part (a)(ii), can be used in car engines.

This is more environmentally friendly than using petrol.

Explain why.

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(3 marks)

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4.4.2.1 Aerobic and anaerobic respiration

Question 08

8 The table shows energy transfers in a large insect and a small mammal. Both animals feed mainly on grass.

Energy transfer	Amount of energy in kJ	
	Large insect	Small mammal
Eaten as grass	4.00	25.00
Absorbed into body	1.60	12.50
Leaves body as faeces	2.40	12.50
Production of new tissue	0.64	0.25
Transferred by respiration	0.96	12.25

8 (a) What percentage of the energy in food is transferred into new tissue in the large insect?

Show clearly how you work out your answer.

.....

.....

.....

Answer = ... %

(2 marks)

4.4.2.1 Aerobic and anaerobic respiration

Question 08 · continued

8 (b) The proportion of energy in the food transferred into new tissue is much greater in the large insect than in the small mammal.

Explain why as fully as you can.

You should include references to the data in your answer.

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(3 marks)

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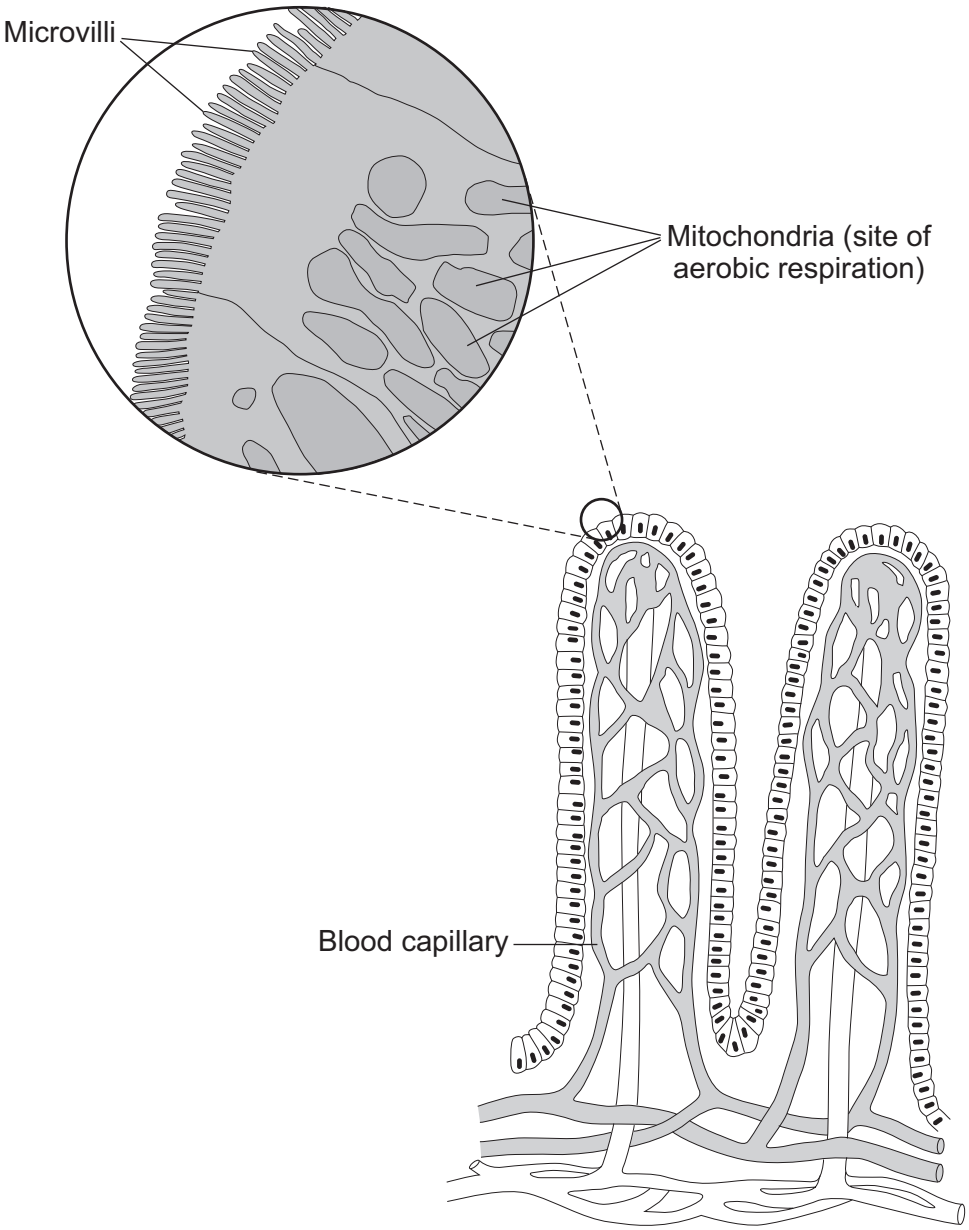
4.4.2.1 Aerobic and anaerobic respiration

Question 09

June 2011 | BLY3H | Original Q5 | Legacy

5 The villi of the small intestine absorb the products of digestion.

The diagram shows two villi. It also shows parts of some of the surface cells of a villus, as seen with an electron microscope.



4.4.2.1 Aerobic and anaerobic respiration

Question 09 · continued

Describe and explain how the villi are adapted to maximise the rate of absorption of the products of digestion.

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(5 marks)

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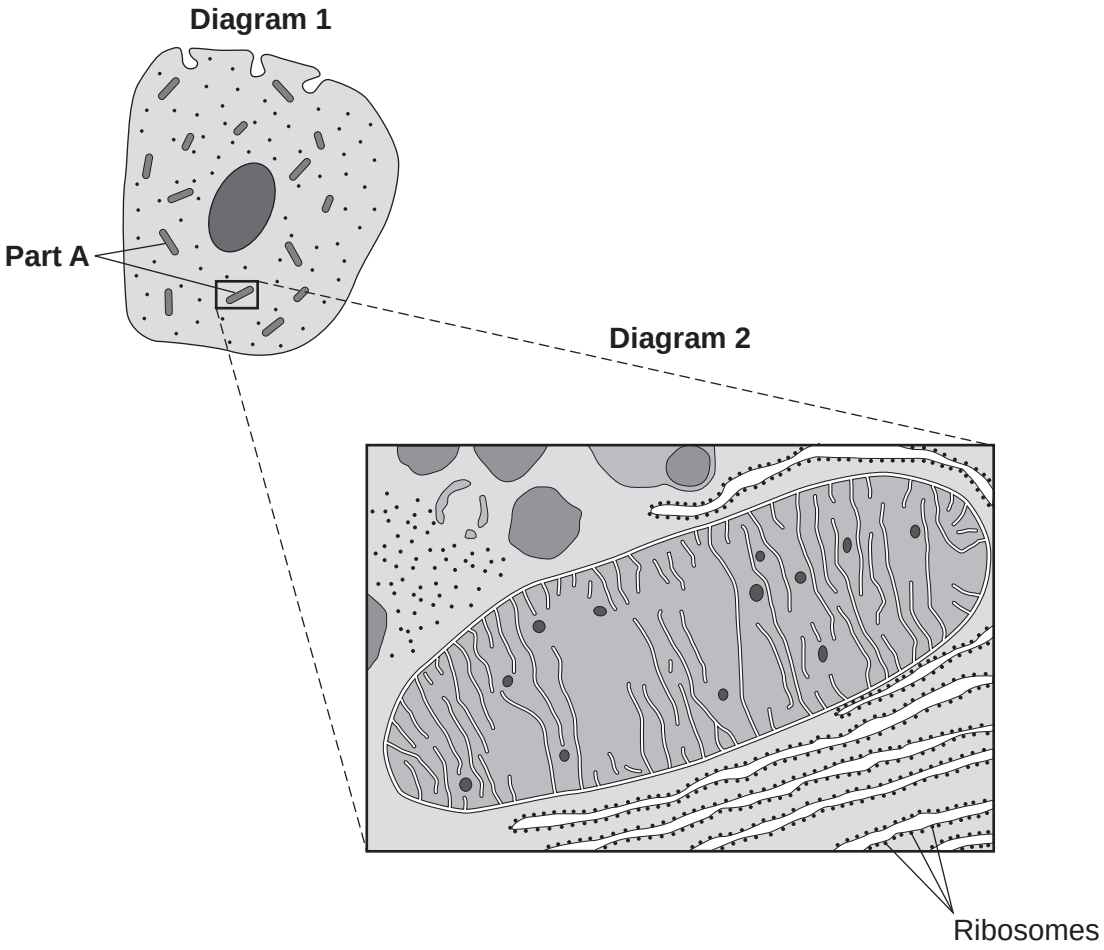
4.4.2.1 Aerobic and anaerobic respiration

Question 10

January 2013 | BL2HP | Original Q3 | Legacy

3 **Diagram 1** shows a cell from the pancreas.

Diagram 2 shows part of the cell seen under an electron microscope.



Part **A** is where most of the reactions of aerobic respiration happen.

3 (a) (i) Name part **A**.

.....

(1 mark)

3 (a) (ii) Complete the equation for aerobic respiration.

glucose + oxygen ⟶ ..... + ... (+ energy)

(2 marks)

4.4.2.1 Aerobic and anaerobic respiration

Question 10 · continued

3 (a) (iii) Part **A** uses oxygen.

Explain how oxygen passes from the blood to part **A**.

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(3 marks)

3 (b) The pancreas cell makes enzymes.

Enzymes are proteins.

Describe how the ribosomes and part **A** help the cell to make enzymes.

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(3 marks)

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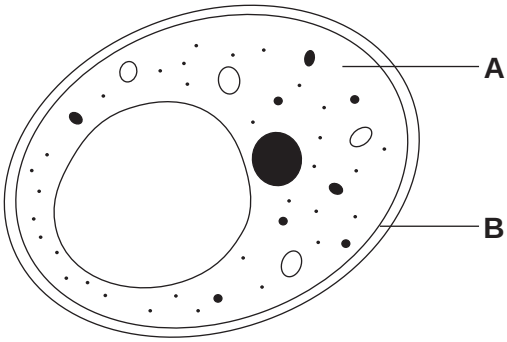
4.4.2.1 Aerobic and anaerobic respiration

Question 11

June 2013 | BL2HP | Original Q4 | Legacy

4 **Diagram 1** shows a yeast cell.

Diagram 1



4 (a) Name structures **A** and **B**.

A .....

B .....

(2 marks)

4 (b) Yeast cells can respire anaerobically.

The equation for anaerobic respiration in yeast is:

glucose ⟶ alcohol + carbon dioxide (+ energy)

Give **one** way in which anaerobic respiration in yeast cells is different from anaerobic respiration in human muscle cells.

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(1 mark)

4.4.2.1 Aerobic and anaerobic respiration

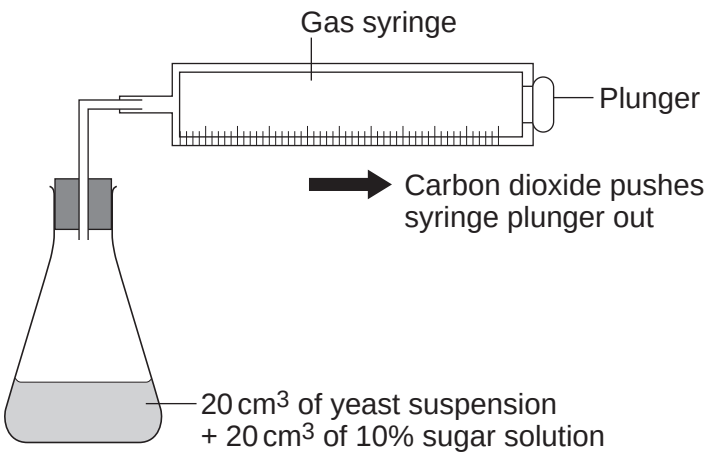
Question 11 · continued

4 (c) Yeast can use other types of sugar instead of glucose.
Some scientists investigated the effect of three different types of sugar on the rate of anaerobic respiration in yeast.

The scientists:

- used the apparatus shown in **Diagram 2** with glucose sugar
- kept the apparatus at 20 °C
- repeated the investigation with fructose sugar and then with mannose sugar
- repeated the investigation with water instead of the sugar solution.

Diagram 2



4 (c) (i) Give **two** control variables the scientists used in this investigation.

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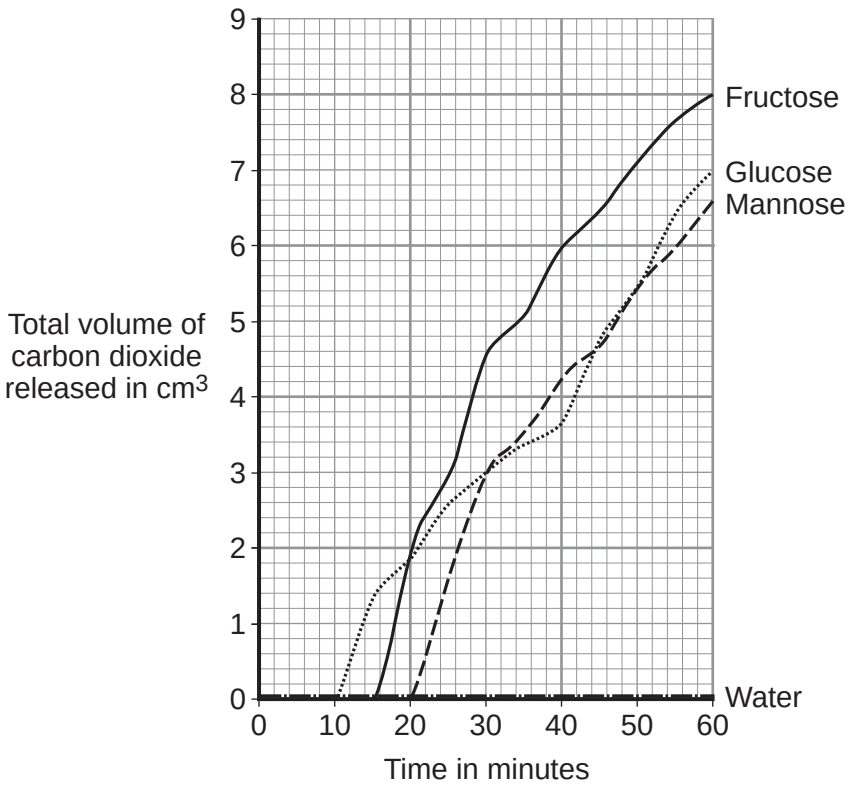
(2 marks)

Question 4 continues on the next page

4.4.2.1 Aerobic and anaerobic respiration

Question 11 · continued

4 (c) (ii) The graph shows the scientists' results.



From this information, a company decided to use fructose to produce alcohol and **not** mannose or glucose.

Explain the reason for the company's choice.

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(2 marks)

7

4.4.2.1 Aerobic and anaerobic respiration

Question 12

June 2014 | BL2HP | Original Q3 | Legacy

3 **Figure 2** shows an athlete running on a treadmill.

Figure 2



After running for several minutes, the athlete's leg muscles began to ache.
This ache was caused by a high concentration of lactic acid in the muscles.

3 (a) The equation shows how lactic acid is made.

glucose ⟶ lactic acid (+ energy)

Name the process that makes lactic acid in the athlete's muscles.

[1 mark]

.....

3 (b) Scientists investigated the production of lactic acid by an athlete running at different speeds.

In the investigation:

- the athlete ran on the treadmill at 4 km per hour
- the scientists measured the concentration of lactic acid in the athlete's blood after 2 minutes of running.

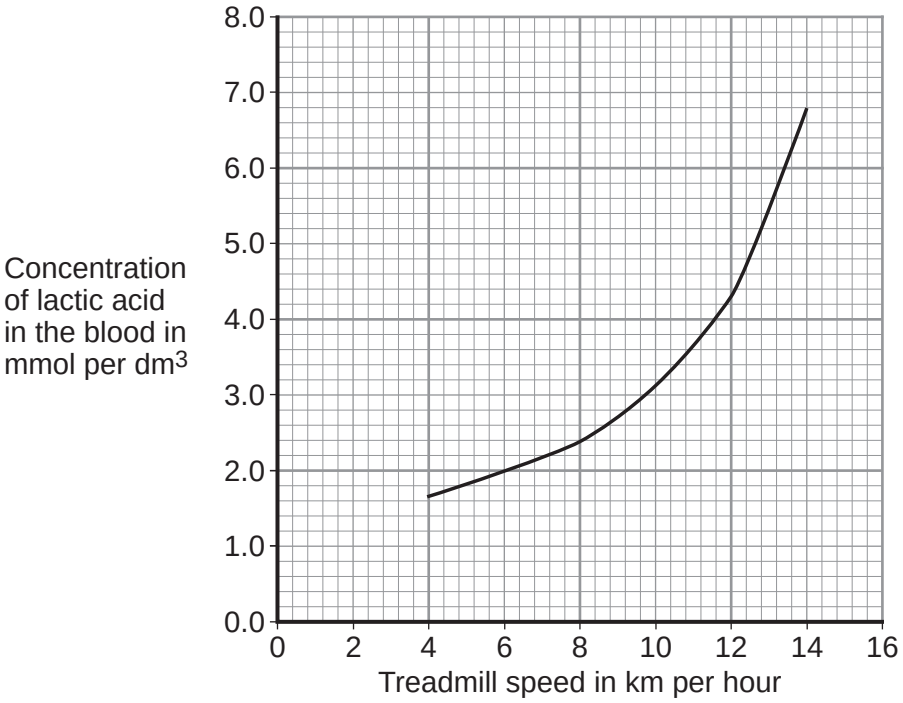
The investigation was repeated for different running speeds.

Figure 3 shows the scientists' results.

4.4.2.1 Aerobic and anaerobic respiration

Question 12 · continued

Figure 3



3 (b) (i) How much more lactic acid was there in the athlete's blood when he ran at 14 km per hour than when he ran at 8 km per hour?

[2 marks]

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.....

Answer = ... mmol per dm^3

3 (b) (ii) Why is more lactic acid made in the muscles when running at 14 km per hour than when running at 8 km per hour?

[3 marks]

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4.4.2.1 Aerobic and anaerobic respiration

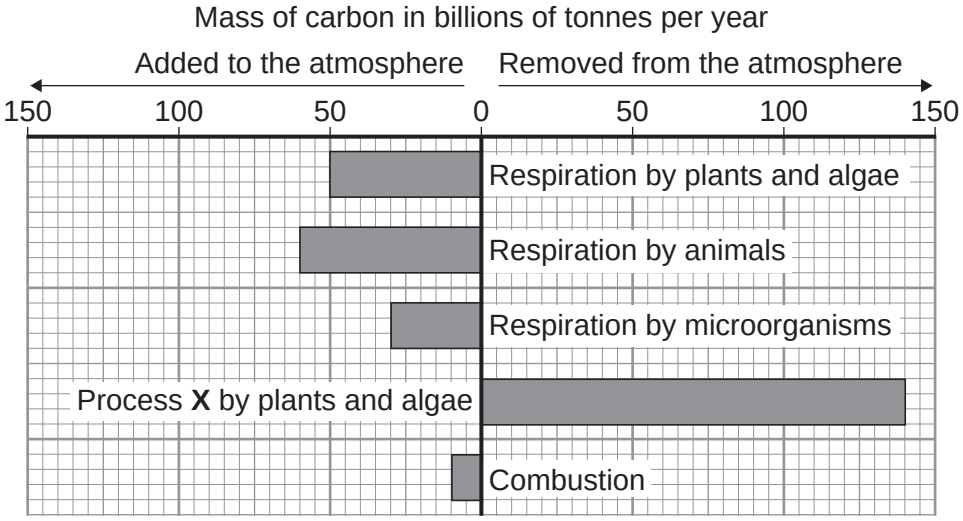
Question 13

June 2015 | BL1HP | Original Q2 | Legacy

2 This question is about carbon.

Figure 2 shows the mass of carbon added to and removed from the atmosphere each year.

Figure 2



2 (a) Name process **X**.

[1 mark]

.....

2 (b) (i) Calculate the mass of carbon added to the atmosphere by respiration per year.

[1 mark]

Answer = ... billion tonnes

2 (b) (ii) Some scientists are concerned that the mass of carbon in the atmosphere is changing.

How does the data in **Figure 2** support this idea?

[1 mark]

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3

4.4.2.1 Aerobic and anaerobic respiration

Question 14

June 2015 | BL3HP | Original Q1 | Legacy

1 The world population is increasing and the need for food is increasing.

Mycoprotein is a high-protein food made in fermenters using the organism *Fusarium*.

The process takes only a few weeks to produce a large amount of food.

1 (a) (i) What type of organism is *Fusarium*?

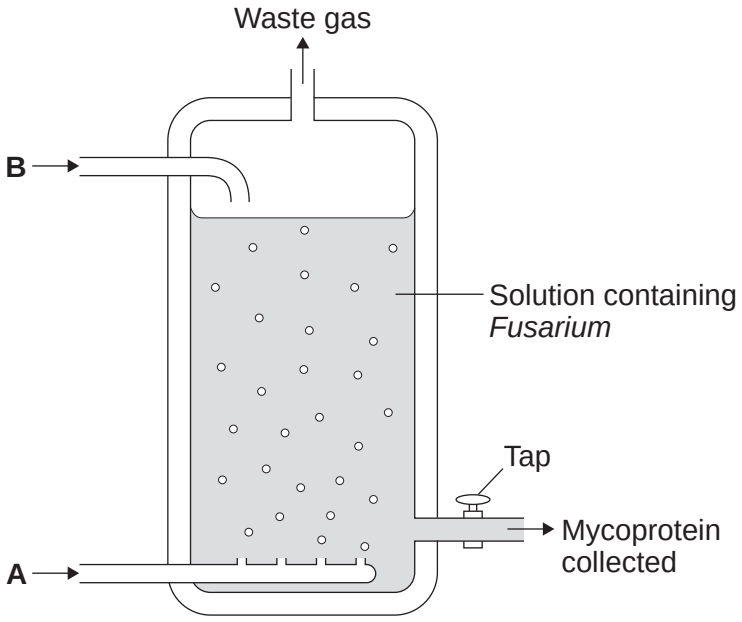
Draw a ring around the correct answer.

[1 mark]

bacterium **fungus** **virus**

Figure 1 shows a fermenter used in mycoprotein production.

Figure 1



1 (a) (ii) *Fusarium* makes mycoprotein. *Fusarium* respires aerobically.

Suggest which gas is added to the fermenter at point **A**.

[1 mark]

.....

4.4.2.1 Aerobic and anaerobic respiration

Question 14 · continued

1 (a) (iii) Another substance is added to the fermenter at point **B**. This substance is used in aerobic respiration.

Name this substance.

[1 mark]

.....

1 (b) People need to eat protein to grow and to be healthy.

Some people think that it would be an advantage to get more food from mycoprotein and less from farming animals.

Suggest **two** possible advantages of getting more food from mycoprotein.

[2 marks]

1 .....

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2 .....

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5

4.4.2.1 Aerobic and anaerobic respiration

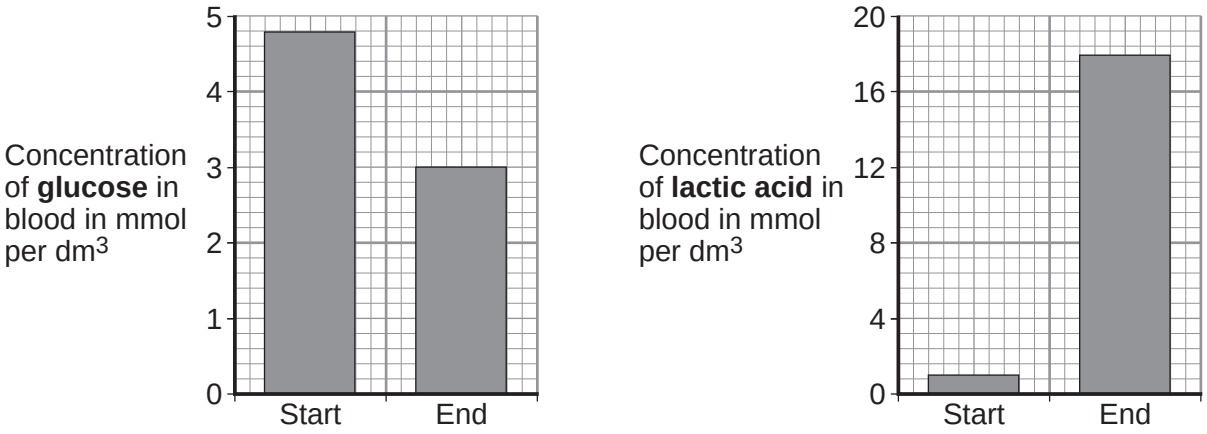
Question 15

June 2016 | BL2HP | Original Q1 | Legacy

1 An athlete ran as fast as he could until he was exhausted.

1 (a) **Figure 1** shows the concentrations of glucose and of lactic acid in the athlete's blood at the start and at the end of the run.

Figure 1



1 (a) (i) Lactic acid is made during anaerobic respiration.

What does anaerobic mean?

[1 mark]

_____

_____

1 (a) (ii) Give evidence from **Figure 1** that the athlete respired anaerobically during the run.

[1 mark]

_____

_____

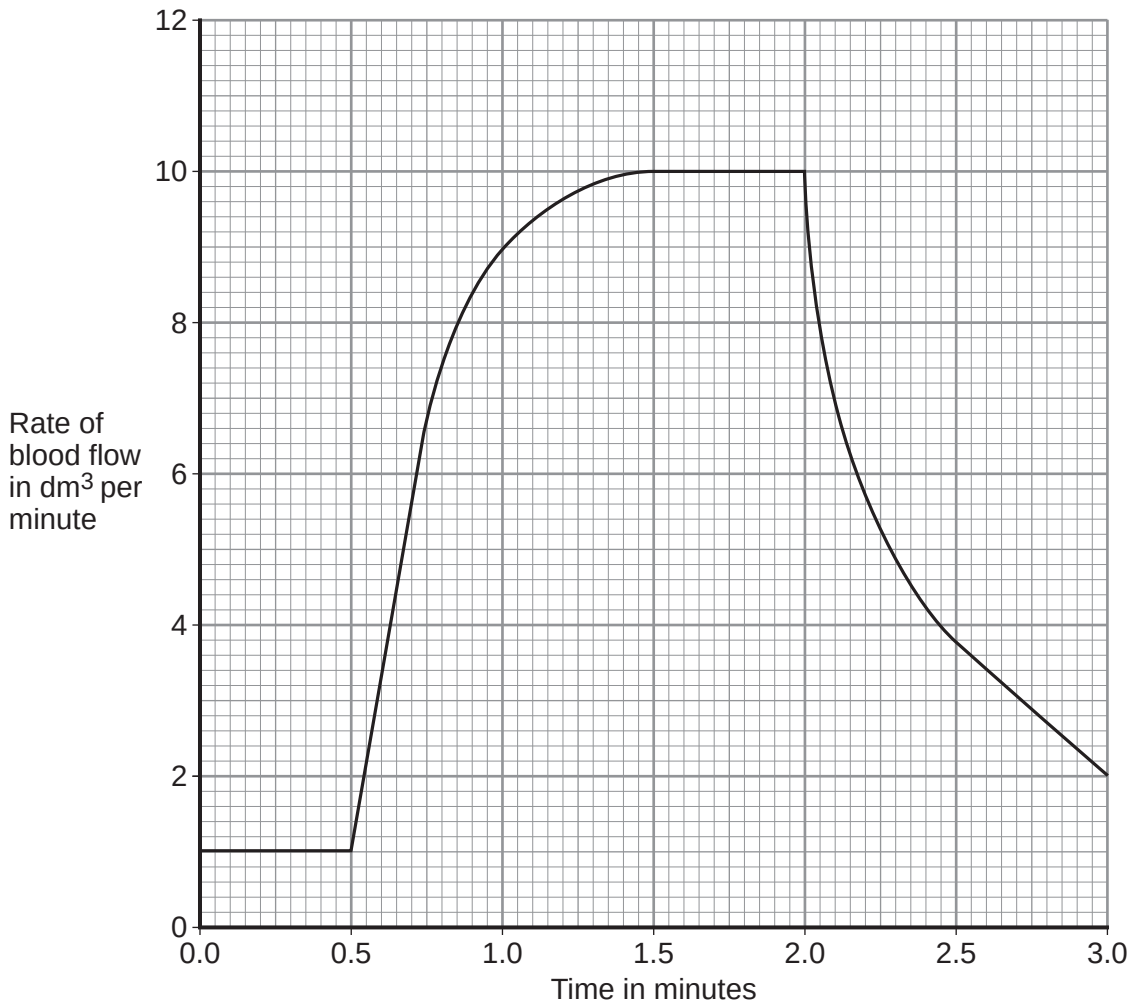
Question 1 continues on the next page

4.4.2.1 Aerobic and anaerobic respiration

Question 15 · continued

1 (b) **Figure 2** shows the effect of running on the rate of blood flow through the athlete's muscles.

Figure 2



1 (b) (i) For how many minutes did the athlete run?

[1 mark]

Time = _____ minutes

1 (b) (ii) Describe what happens to the rate of blood flow through the athlete's muscles during the run.

Use data from **Figure 2** in your answer.

[2 marks]

_____

_____

_____

_____

4.4.2.1 Aerobic and anaerobic respiration

Question 15 · continued

1 (b) (iii) Explain how the change in blood flow to the athlete's muscles helps him to run.

[4 marks]

9

4.4.2.1 Aerobic and anaerobic respiration

Question 16

June 2017 | BL1HP | Original Q7 | Legacy

7 Reproduction may be sexual or asexual.

7 (a) Describe **one** advantage to a species of sexual reproduction rather than asexual reproduction.

[1 mark]

_____

_____

7 (b) Mitochondria contain genes. The genes control some of the reactions in respiration.

In a person with mitochondrial disease, genes in the mitochondria are faulty. The person may have muscle weakness, blindness and heart failure.

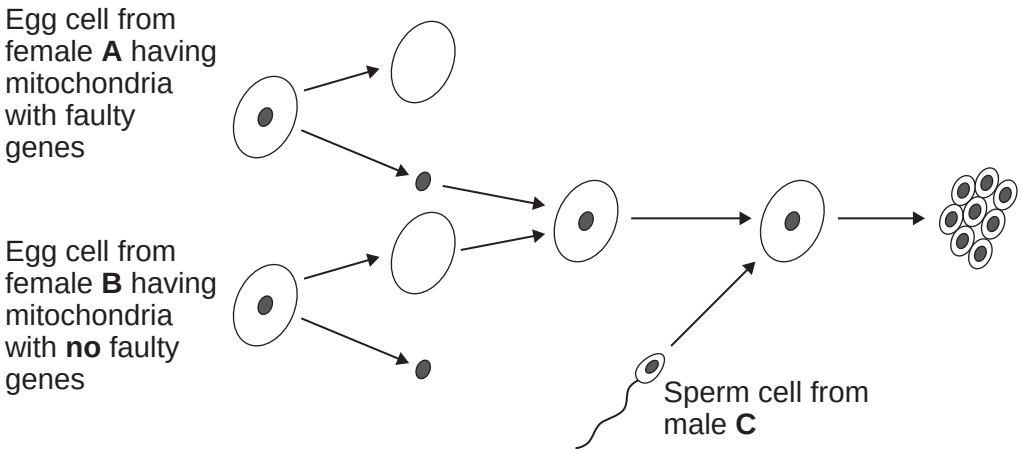
In human reproduction, an embryo will have mitochondria from the cytoplasm of the mother's egg cell.

Scientists have developed a way of solving the problem of a child inheriting mitochondrial disease.

Figure 6 shows the process.

The cells involved come from three different people, **A**, **B** and **C**.

Figure 6



4.4.2.1 Aerobic and anaerobic respiration

Question 16 · continued

7 (b) (i) Describe the process shown in **Figure 6**.

Use your knowledge of sexual reproduction and adult cell cloning.

[4 marks]

7 (b) (ii) Explain why the embryo formed from the process shown in **Figure 6** will **not** have mitochondrial disease.

[2 marks]

7 (b) (iii) Suggest **one** ethical objection to this process being used for reproduction in humans.

[1 mark]

8

4.4.2.1 Aerobic and anaerobic respiration

Question 17

November 2021 | 8461/1H | Original Q4

0 4 All living organisms respire.

0 4 . 1 What is the chemical equation for aerobic respiration?

[1 mark]

Tick (✓) **one** box.

$6\,O_2 + 6\,CO_2 \rightarrow 6\,H_2O + C_6H_{12}O_6$ ☐

$6\,H_2O + C_6H_{12}O_6 \rightarrow 6\,H_2O + 6\,CO_2$ ☐

$6\,H_2O + 6\,CO_2 \rightarrow 6\,O_2 + C_6H_{12}O_6$ ☐

$6\,O_2 + C_6H_{12}O_6 \rightarrow 6\,H_2O + 6\,CO_2$ ☐

0 4 . 2 Name the sub-cellular structures where aerobic respiration takes place.

[1 mark]

_____

0 4 . 3 Energy is released in respiration.

Give **two** uses of the energy released in respiration.

[2 marks]

1 _____

_____

2 _____

_____

4.4.2.1 Aerobic and anaerobic respiration

Question 17 · continued

0 4 . 4 Describe **two** differences between aerobic and anaerobic respiration in humans.

Do **not** refer to oxygen in your answer.

[2 marks]

1 _____

_____

2 _____

_____

0 4 . 5 What are the **two** products of anaerobic respiration in plant cells?

[2 marks]

Tick (✓) **two** boxes.

- Carbon dioxide ☐
- Ethanol ☐
- Glucose ☐
- Lactic acid ☐
- Water ☐

Question 4 continues on the next page

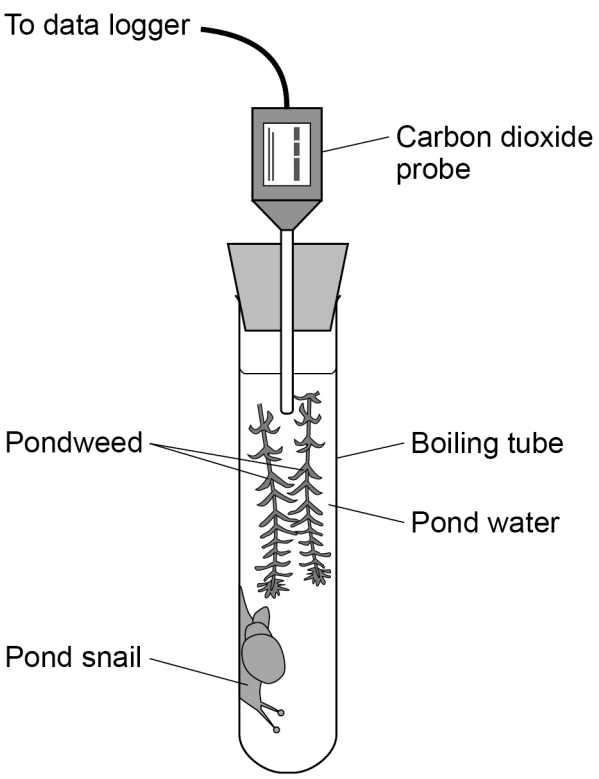
4.4.2.1 Aerobic and anaerobic respiration

Question 17 · continued

A scientist investigated respiration and photosynthesis using some pondweed and a pond snail.

Figure 6 shows the apparatus used.

Figure 6



The apparatus was left in a well-lit room for 5 days.

The data logger recorded the concentration of carbon dioxide continuously.

After 5 days, the scientist completely covered the boiling tube with black paper.

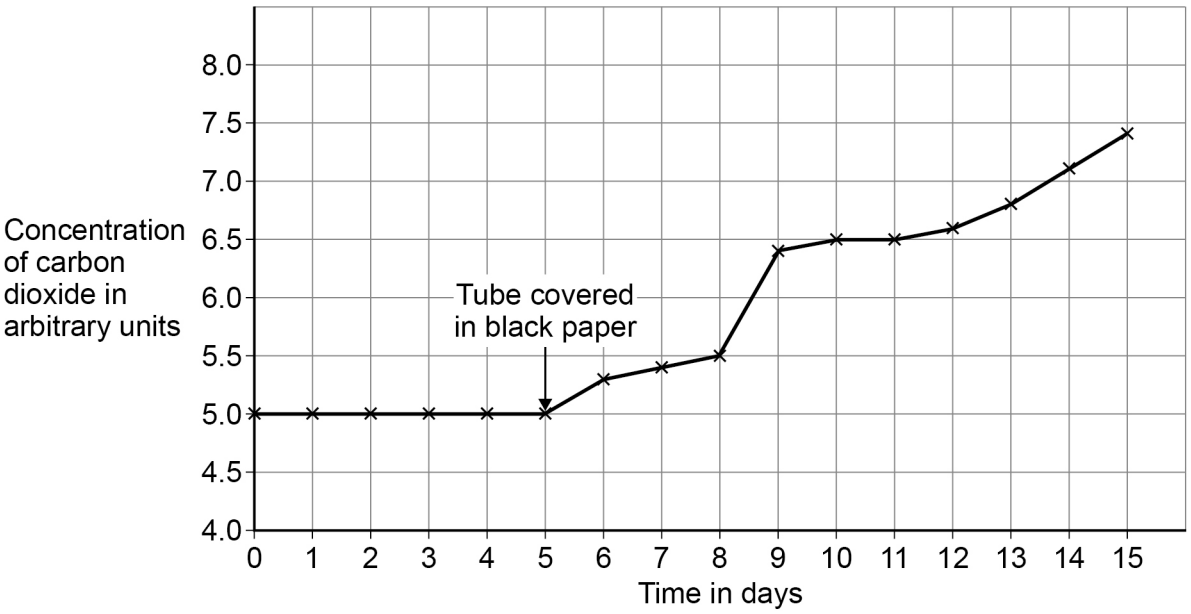
The data logger continued to record the concentration of carbon dioxide.

4.4.2.1 Aerobic and anaerobic respiration

Question 17 · continued

Figure 7 shows the concentration of carbon dioxide inside the boiling tube over 15 days.

Figure 7



0 4 . 6 Explain why the concentration of carbon dioxide in the tube stayed the same between day 0 and day 5.

[2 marks]

0 4 . 7 Suggest why the concentration of carbon dioxide increased between day 5 and day 10.

[1 mark]

Question 4 continues on the next page

4.4.2.1 Aerobic and anaerobic respiration

Question 17 · continued

0 4 . 8 On day 10, the pond snail died.

Explain why the death of the pond snail caused the concentration of carbon dioxide to increase after day 10.

[3 marks]

14

4.4.2.1 Aerobic and anaerobic respiration

Question 18

June 2023 | 8461/1H | Original Q4

0 4 This question is about exercise.

0 4 . 1 During vigorous exercise, anaerobic respiration occurs in a person's body.

Explain **two** effects of anaerobic respiration on the person's body.

[4 marks]

1 _____

2 _____

4.4.2.1 Aerobic and anaerobic respiration

Question 18 · continued

0 4 . 2 Design an investigation to show the effect of different types of exercise on the heart rate of athletes.

[6 marks]

Question 4 continues on the next page

4.4.2.1 Aerobic and anaerobic respiration

Question 18 · continued

Anabolic steroids are drugs.

Anabolic steroids:

- increase muscle mass in humans
- are banned in most competitive sports.

Some athletes take anabolic steroids to improve their performance in sport.

0 4 . 3 Explain how taking anabolic steroids could improve an athlete's performance.

[2 marks]

Scientists use monoclonal antibodies to test for the presence of anabolic steroids in an athlete's urine.

To produce monoclonal antibodies, a mouse lymphocyte is combined with a tumour cell.

0 4 . 4 What type of cell is created when a mouse lymphocyte and a tumour cell combine?

[1 mark]

Tick (✓) **one** box.

- Embryo ☐
- Hybridoma ☐
- Phagocyte ☐
- Stem cell ☐

4.4.2.1 Aerobic and anaerobic respiration

Question 18 · continued

0 4 . 5 Describe how scientists make monoclonal antibodies using the cell created when a mouse lymphocyte and a tumour cell combine.

[3 marks]

0 4 . 6 What property makes a monoclonal antibody useful in detecting the presence of an anabolic steroid in urine?

[1 mark]

Tick (✓) **one** box.

A monoclonal antibody is quick and easy to produce. ☐

A monoclonal antibody is specific to only one person's urine. ☐

A monoclonal antibody only binds to the anabolic steroid. ☐

A monoclonal antibody can identify many different drugs at the same time. ☐

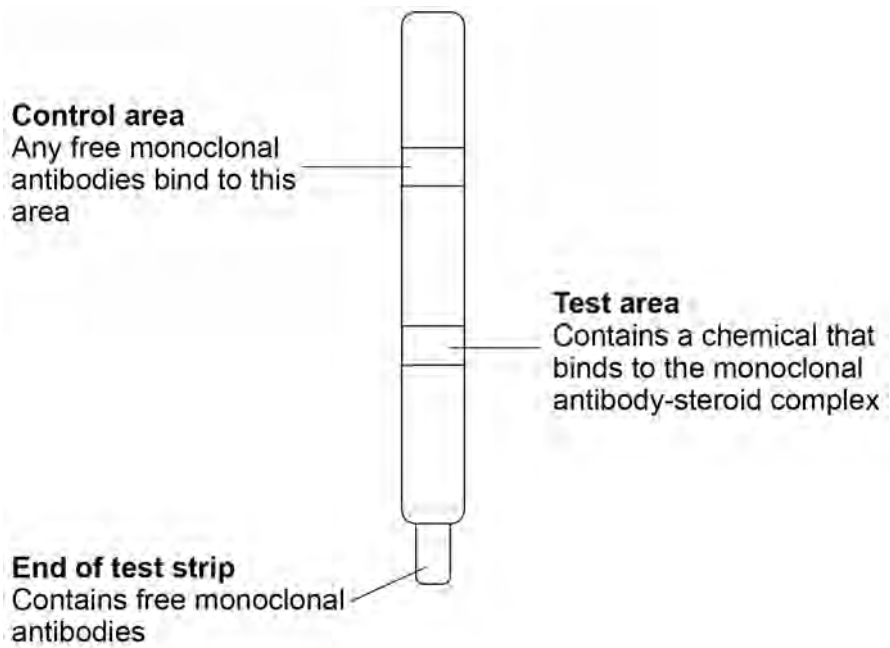
Question 4 continues on the next page

4.4.2.1 Aerobic and anaerobic respiration

Question 18 · continued

Figure 5 shows a test strip that can detect the presence of an anabolic steroid in an athlete's urine.

Figure 5



The end of the test strip is dipped in urine.

The urine moves up through the test strip.

The test area and the control area contain a dye.
The dye turns blue when monoclonal antibodies bind to it.

0 4 . 7 Suggest the purpose of the control area in the test strip.

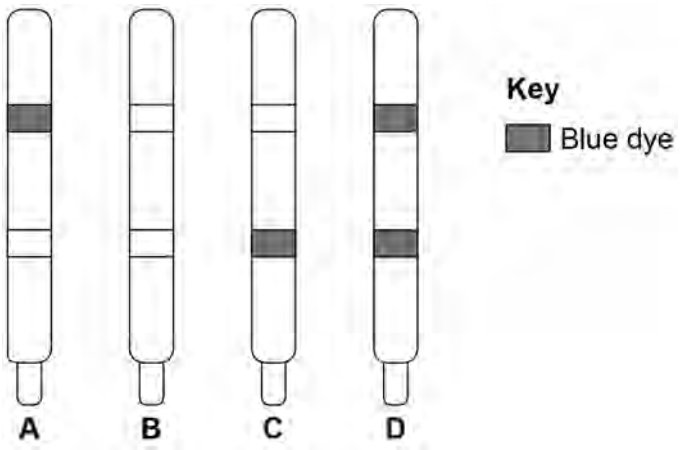
[1 mark]

4.4.2.1 Aerobic and anaerobic respiration

Question 18 · continued

Figure 6 shows the urine test results of four athletes.

Figure 6



0 4 . 8 Describe the evidence in **Figure 6** that shows the test for athlete **B** has **not** worked.

Suggest **one** reason why the test did **not** work.

[2 marks]

Evidence _____

_____

Reason _____

_____

0 4 . 9 Which athlete has tested positive for anabolic steroids in their urine?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

21

4.4.2.1 Aerobic and anaerobic respiration

Question 19

June 2023 | 8461/2H | Original Q6

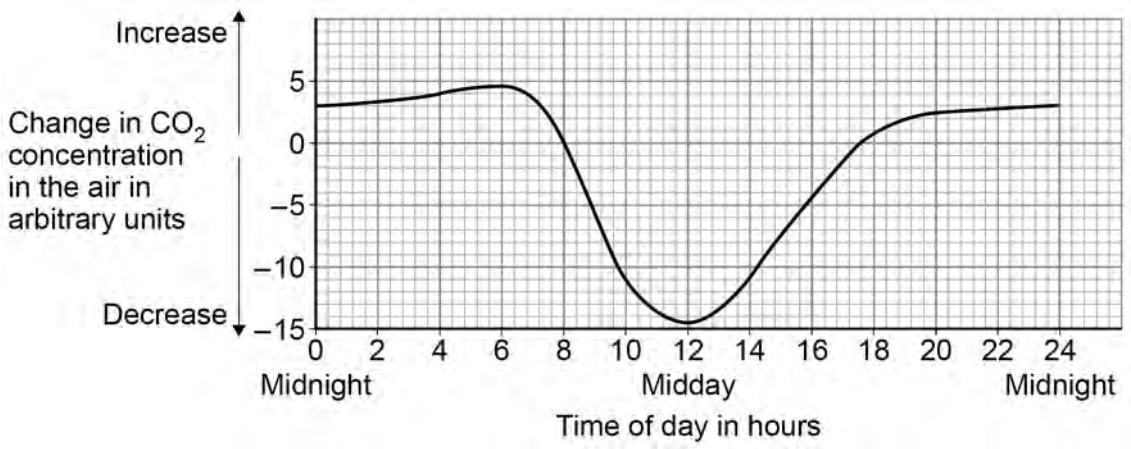
0 6 This question is about the effects of deforestation and agriculture.

The processes of photosynthesis and respiration affect the carbon dioxide concentration in the air.

Figure 9 shows the changes in the carbon dioxide concentration in the air in a tropical rainforest during one day.

The data are mean daily values over a whole year.

Figure 9



0 6 . 1 Explain what causes the changes in the carbon dioxide concentration in the air:

- from 0 to 6 hours
- from 8 to 12 hours.

Use information from **Figure 9**.

[4 marks]

0 to 6 hours _____

_____

_____

_____

8 to 12 hours _____

_____

_____

_____

Question 19 · continued

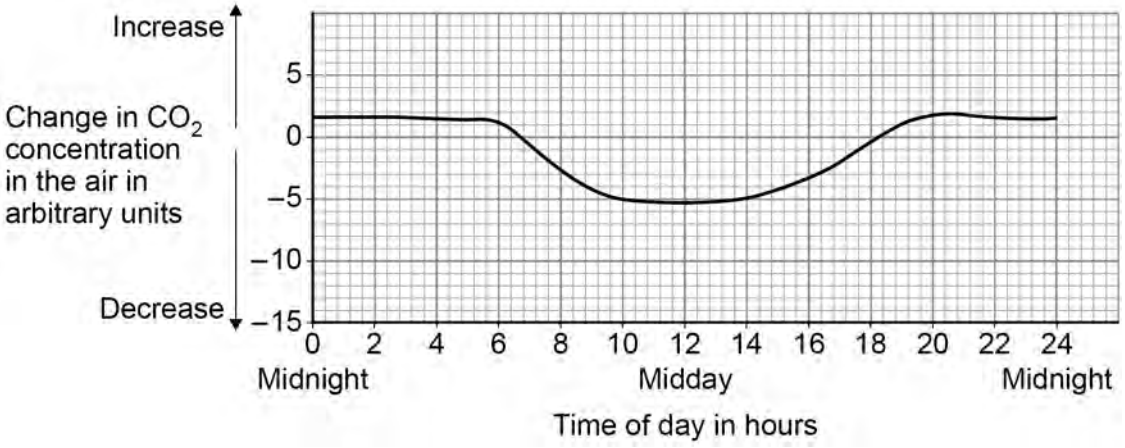
0 6 . 2 An area of rainforest is cut down and replaced with a field of maize plants.

Only one crop of maize is grown each year.

Figure 10 shows the changes in the carbon dioxide concentration in the air in the field of maize during one day.

The data are mean daily values over the 6-month growing period.

Figure 10



The maize grows for only 6 months of the year.

Explain why replacing rainforest with maize will increase the carbon dioxide concentration in the air after one year.

Use information from **Figure 9** and **Figure 10**.

[2 marks]

Question 6 continues on the next page

Question 19 · continued

A tropical rainforest can contain over 1000 different tree species.

Large areas of tropical rainforest have been cut down during the last 100 years so crops can be grown.

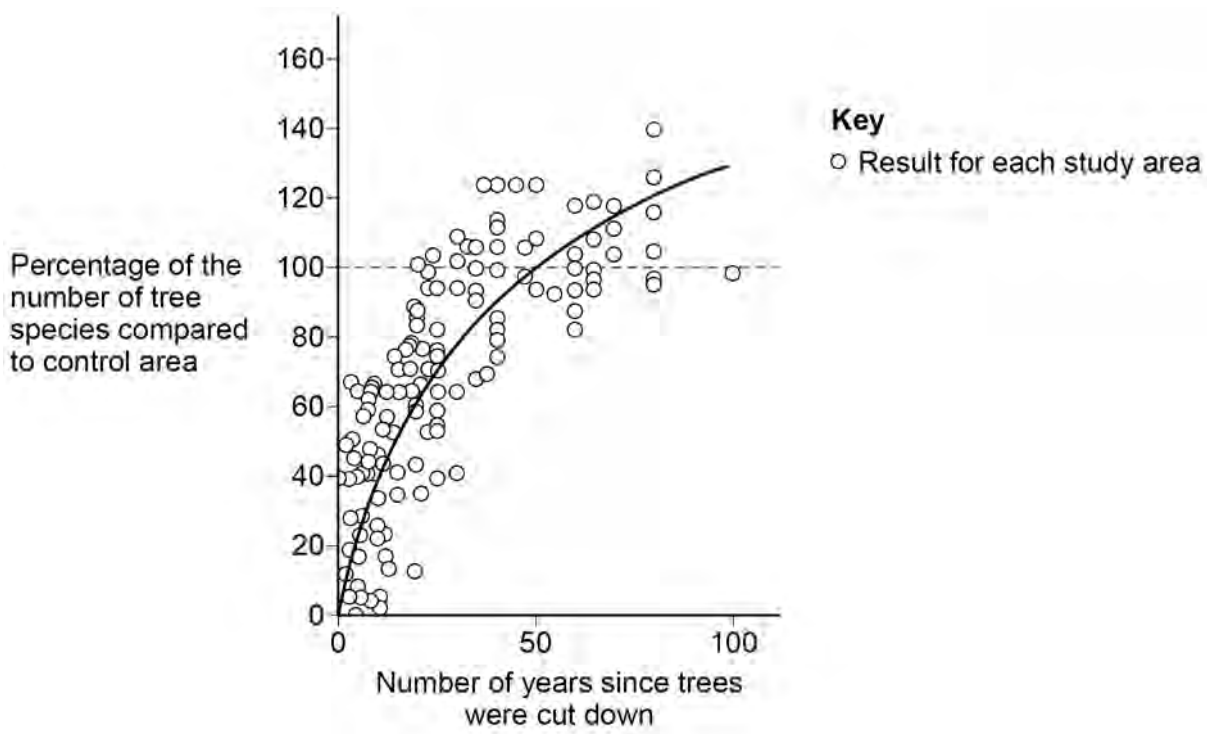
Scientists studied the regeneration of different areas of tropical rainforest.

The scientists:

- investigated areas of rainforest that had been cut down at different times during the previous 100 years
- recorded the number of tree species that re-grew in each area
- compared each area with a control area next to it. The control areas were undisturbed rainforest which had never been cut down.

Figure 11 shows the scientists' results.

Figure 11



4.4.2.1 Aerobic and anaerobic respiration

Question 19 · continued

0 6 . 3 The values plotted in **Figure 11** are percentages of the results for the control areas.

Explain why the scientists presented their results as **percentages**.

[2 marks]

During the 100 years, the biodiversity of trees in the regenerating rainforest increases.

0 6 . 4 Give **one** other conclusion you can make from **Figure 11**.

[1 mark]

0 6 . 5 Give **two** reasons why an increase in the diversity of trees in the rainforest leads to an increase in animal diversity.

[2 marks]

1

2

11

4.4.2.1 Aerobic and anaerobic respiration

Question 20

June 2024 | 8461/2H | Original Q7

0 7 Farmers can increase the growth rate of farm animals by controlling the animals' diets.

A farmer has 1000 chickens.

- The farmer feeds the chickens on seeds from maize plants.
- 1 hectare of land produces 16.4 tonnes of maize seeds.
- The maize seeds have an energy content of 16 MJ per kg.
- Chickens can use 80% of the energy in maize seeds.
- Each chicken needs 46 MJ of energy to grow to full size.

0 7 . 1 Calculate the area of land needed to provide enough energy from maize seeds for 1000 chickens to grow to full size.

Give your answer in m^2.

Give your answer to 3 significant figures.

1 hectare = 10 000 m^2

1 tonne = 1000 kg

[5 marks]

Area of land (3 significant figures) = _____ m^2

Question 7 continues on the next page

4.4.2.1 Aerobic and anaerobic respiration

Question 20 · continued

0 7 . 2 Another farmer produced 4200 kg of maize seeds in a field.

The farmer fed the maize to 1000 chickens.

At full size, the mean mass of one chicken was 2.2 kg.

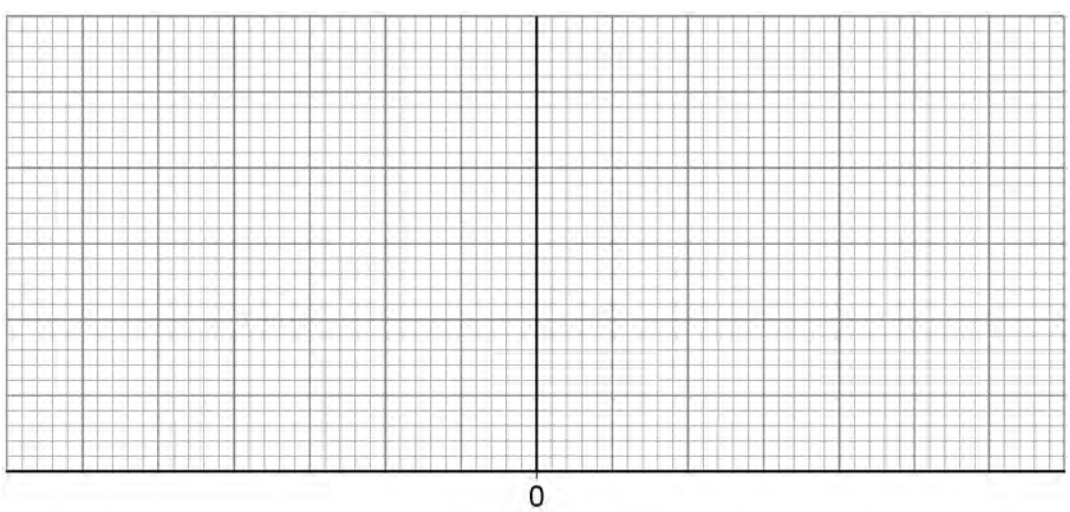
Complete **Figure 11** to show a pyramid of biomass for the food chain from the maize seeds to 1000 chickens.

[3 marks]

You should:

- label the x-axis
- use a suitable scale.

Figure 11



4.4.2.1 Aerobic and anaerobic respiration

Question 20 · continued

0 7 . 3 Calculate the ratio of chicken biomass to maize seed biomass.

Use data from Question **07.2**.

Give your answer in its simplest form.

[2 marks]

Ratio = _____ : _____

0 7 . 4 Chickens can use 80% of the biomass from the maize seeds they eat for respiration and growth.

What happens to the remaining 20% of the biomass in the maize seeds?

[1 mark]

Question 7 continues on the next page

4.4.2.1 Aerobic and anaerobic respiration

Question 20 · continued

Protein is an important part of a chicken's diet.

- Proteins contain 20 different types of amino acid.
- A chicken can make many of the 20 amino acids from other substances in the diet.
- Essential amino acids are amino acids the chicken **cannot** make.
- Essential amino acids must be included in the diet.

Maize seeds contain protein but the proportion of some essential amino acids is low.

Scientists have produced a type of maize called Quality Protein Maize (QPM).

Table 2 compares the proportions of seven essential amino acids in normal maize seeds and in QPM seeds.

Table 2

Amino acid	Mass of amino acid in protein in g/kg	
	Normal maize	Quality protein maize (QPM)
Leucine	122.2	88.1
Lysine	28.9	41.9
Methionine	19.9	18.1
Phenylalanine	49.4	40.9
Threonine	34.5	36.5
Tryptophan	7.3	16.3
Valine	45.9	51.2

4.4.2.1 Aerobic and anaerobic respiration

Question 20 · continued

0 7 . 5 Which amino acids are found in significantly higher proportions in the QPM seeds?

[1 mark]

Tick (✓) **one** box.

- Lysine and tryptophan ☐
- Lysine and valine ☐
- Threonine and tryptophan ☐
- Threonine and valine ☐

0 7 . 6 **Table 2** shows that 1 kg of QPM contains less leucine than 1 kg of normal maize.

Suggest why a diet containing less leucine does **not** slow down the growth of chickens.

[1 mark]

_____

_____

13

4.4.2.1 Aerobic and anaerobic respiration

Question 21

June 2025 | 8461/1H | Original Q5

0 5 This question is about the human circulatory system.

0 5 . 1 Blood plasma transports blood cells around the body.

Give **one** other function of blood plasma.

Do **not** refer to oxygen in your answer.

[1 mark]

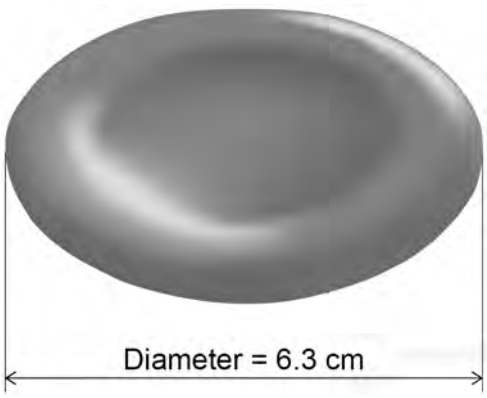
Question 5 continues on the next page

4.4.2.1 Aerobic and anaerobic respiration

Question 21 · continued

0 5 . 2 **Figure 5** shows a red blood cell.

Figure 5



The image of the red blood cell in **Figure 5** is magnified 7200 times.

Calculate the real diameter of the red blood cell.

Give your answer in micrometres (µm).

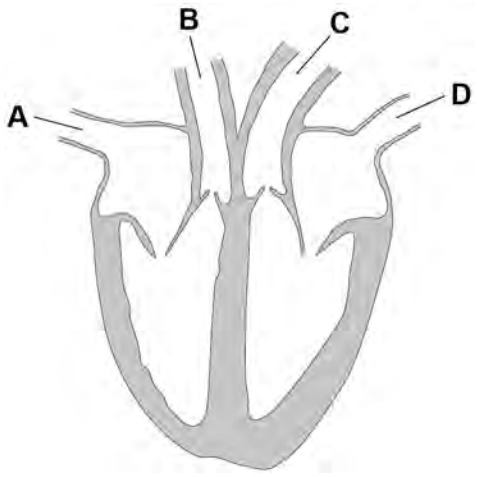
[5 marks]

Real diameter = _____ µm

Question 21 · continued

Figure 6 shows the heart.

Figure 6



0 5 . 3 Blood pressure is a measure of the force of the blood against the walls of the blood vessels.

Table 5 shows information about the different types of blood vessel shown in **Figure 6**.

[2 marks]

Table 5

Pressure of blood travelling through blood vessel in arbitrary units	Blood vessel in Figure 6
4	**D**
5	
18	
120	

Complete **Table 5** using the correct letters from **Figure 6**.

One row has been completed for you.

0 5 . 4 Name blood vessel **D** in **Figure 6**.

[1 mark]

Question 5 continues on the next page

4.4.2.1 Aerobic and anaerobic respiration

Question 21 · continued

0 5 . 5 Describe the structure of the walls of an artery.

[1 mark]

An athlete ran on a running machine.

The athlete:

- reached their maximum intensity of exercise and then stopped exercising
- had their use of oxygen recorded
- had the lactic acid concentration in their blood recorded.

0 5 . 6 During the exercise the athlete respired aerobically **and** anaerobically.

Explain why anaerobic respiration is less efficient than aerobic respiration.

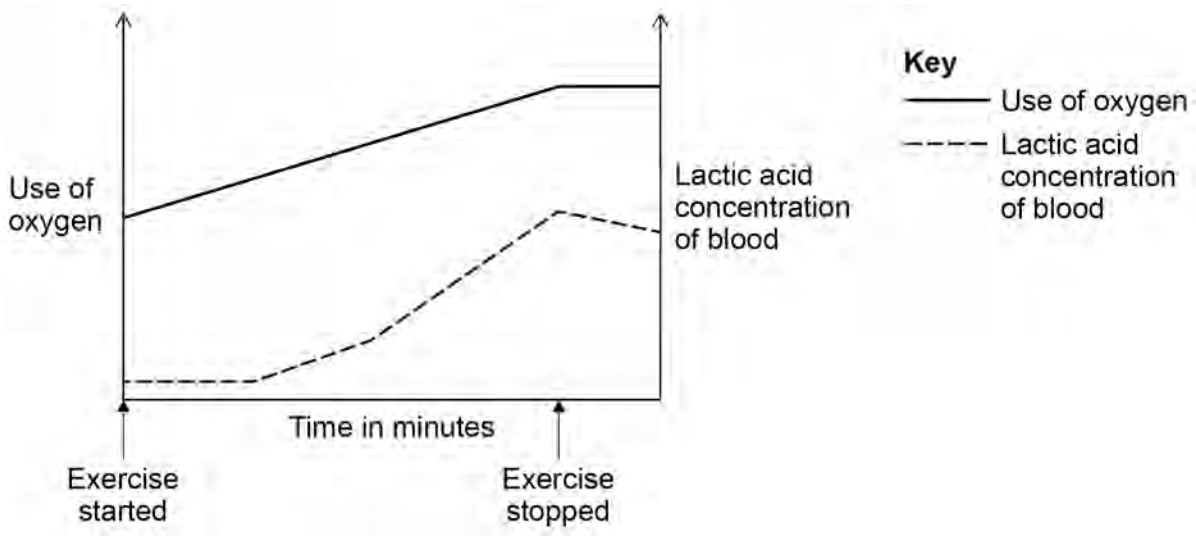
[2 marks]

4.4.2.1 Aerobic and anaerobic respiration

Question 21 · continued

Figure 7 shows the athlete's use of oxygen and the lactic acid concentration of blood during exercise and after exercise.

Figure 7



0 5 . 7 Explain why the use of oxygen remained high **after** the athlete stopped exercising.

[2 marks]

Question 5 continues on the next page

4.4.2.1 Aerobic and anaerobic respiration

Question 21 · continued

0 5 . 8 Some athletes regularly exercise in conditions that increase the number of red blood cells.

Explain why having an increased number of red blood cells is an advantage to an athlete.

[2 marks]

16