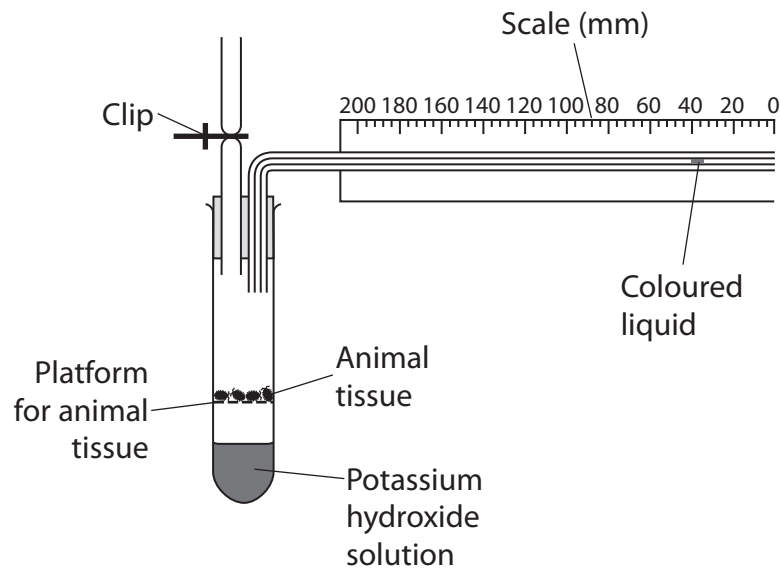


- 1 The tissues of some animals can carry out anaerobic and aerobic respiration.
- (a) Three investigations were carried out to study respiration in an animal tissue, using the apparatus shown below.

The tissue used glucose as the respiratory substrate.

All other variables were kept constant.



The table below shows the three investigations that were carried out and the result for investigation 1.

Investigation	Type of respiration	Potassium hydroxide solution absent or present	Coloured liquid moved to the left	Coloured liquid moved to the right	Coloured liquid did not move
1	Anaerobic	Absent	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2	Aerobic	Absent	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Aerobic	Present	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- (i) Complete the table by placing a cross in one box for each of investigations 2 and 3 to show the response of the coloured liquid.

(2)

(b) Explain how investigation 3, shown in the table, could be used to compare the rate of respiration of two different tissues.

(2)

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(Total for Question 1 = 11 marks)

2 Dark chocolate contains a chemical called epicatechin.

An investigation was carried out to study the effect of epicatechin on mice.

Two groups of one-year-old male mice, group A and group B, were used in this investigation.

The mice in group A were given water containing epicatechin at a concentration of 1 mg per kg of their body mass, twice a day for 15 days. The mice in group B were given water without epicatechin added.

All other variables were kept constant.

- (a) Suggest why the mice in group A were given water containing epicatechin at a concentration of 1 mg per kg of their body mass rather than at a concentration of 1 mg per mouse.

(3)

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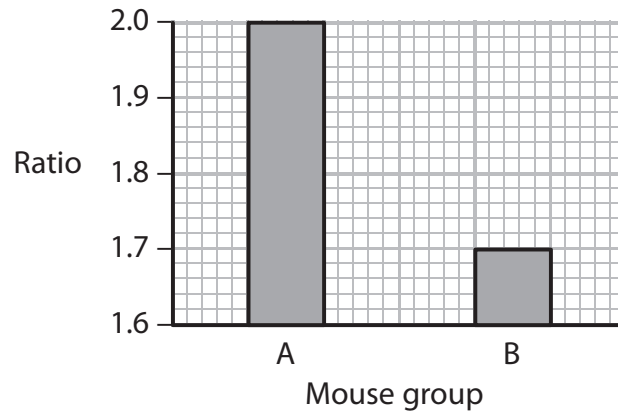
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(b) After 15 days, skeletal muscle from the mice in the groups was compared.

- (i) Skeletal muscle cells contain mitochondria. The surface areas of the inner and outer membranes of the mitochondria were compared.

The surface area of the inner membrane was divided by the surface area of the outer membrane to obtain a ratio.

The bar chart below shows the ratios for the two groups of mice.



Use the information in the bar chart to describe the effect of epicatechin on the mitochondria.

(2)

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3 Dark chocolate contains a chemical called epicatechin.

An investigation was carried out to study the effect of epicatechin on mice.

Three groups of one-year-old male mice, group A, group B and group C, were used in an investigation lasting 15 days.

The table below shows how each group of mice was treated.

Group	Epicatechin added to drinking water	Extra exercise
A	Yes	No
B	No	No
C	No	Yes

All other variables were kept constant and after 15 days skeletal muscle from the mice in each group was studied.

- (a) The ability of the skeletal muscle to contract was compared. The time taken for the muscle to start to fatigue (fail to contract) was recorded.

The results are shown in the table below.

Group	Time taken for skeletal muscle to fatigue / seconds	
	Mean	Range
A	164	± 10
B	130	± 4
C	128	± 5

A statistical test was carried out on the results.

The test showed that the addition of epicatechin had a significant effect on the time taken for mouse skeletal muscle to fatigue. The test also showed that extra exercise had no significant effect.

Use the results table to supply evidence that the addition of epicatechin had a significant effect but extra exercise had no effect.

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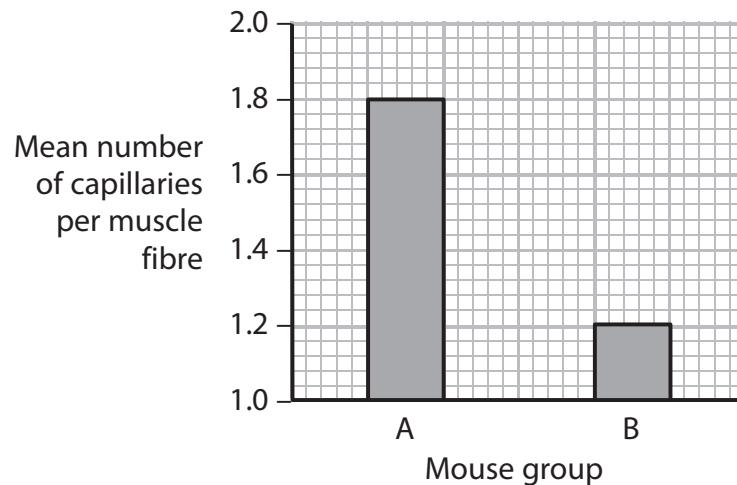
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(b) The mean number of capillaries per muscle fibre was found for the skeletal muscle from groups A and B.

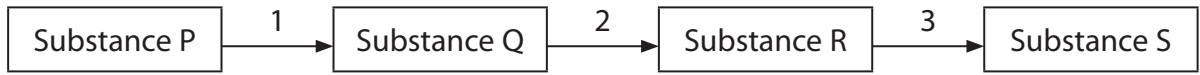
The bar chart below shows the results.



4 Respiration is a metabolic process which consists of many steps.

(a) The diagram below shows a metabolic process consisting of three steps.

Each letter represents a different substance and each number a different enzyme.



Describe and explain the functions of enzymes in this metabolic process.

(4)

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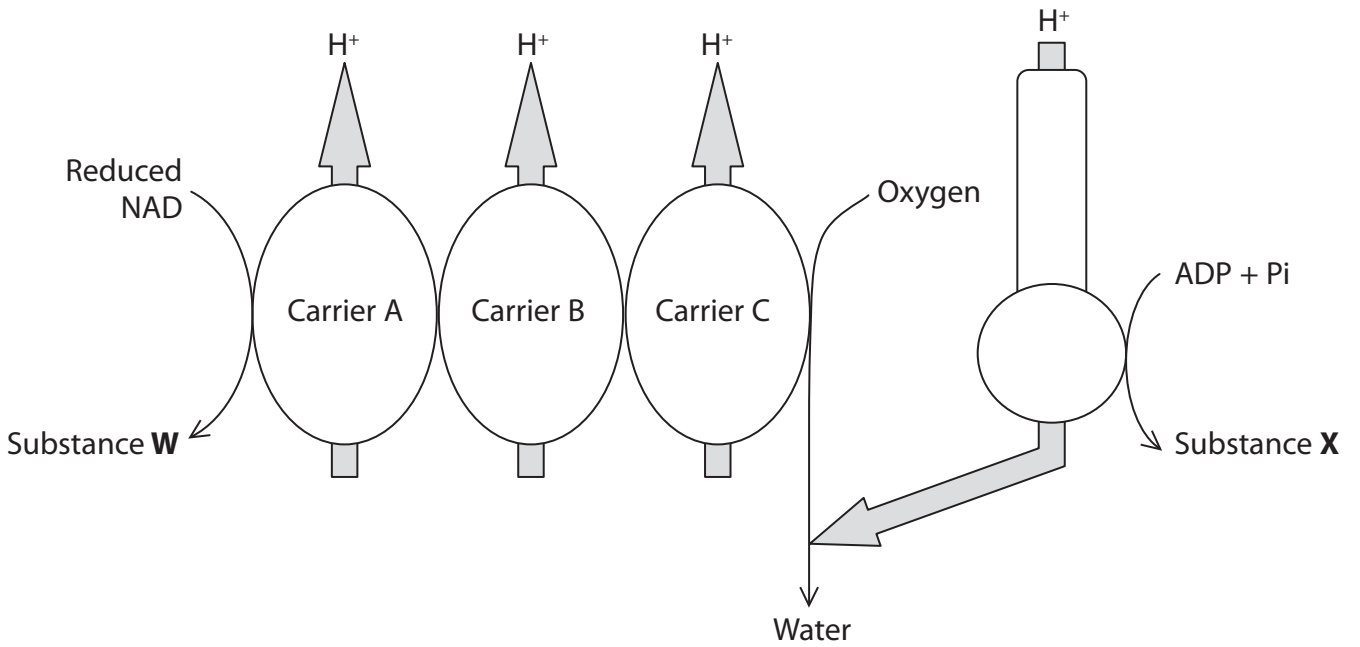
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(b) The diagram below shows the electron transport chain, which is part of aerobic respiration.



(i) Using the information in the diagram, name substance **W** and explain how it is formed.

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(ii) Name substance **X**.

Explain the link between the formation of substance **X** and the H^+ shown on the diagram.

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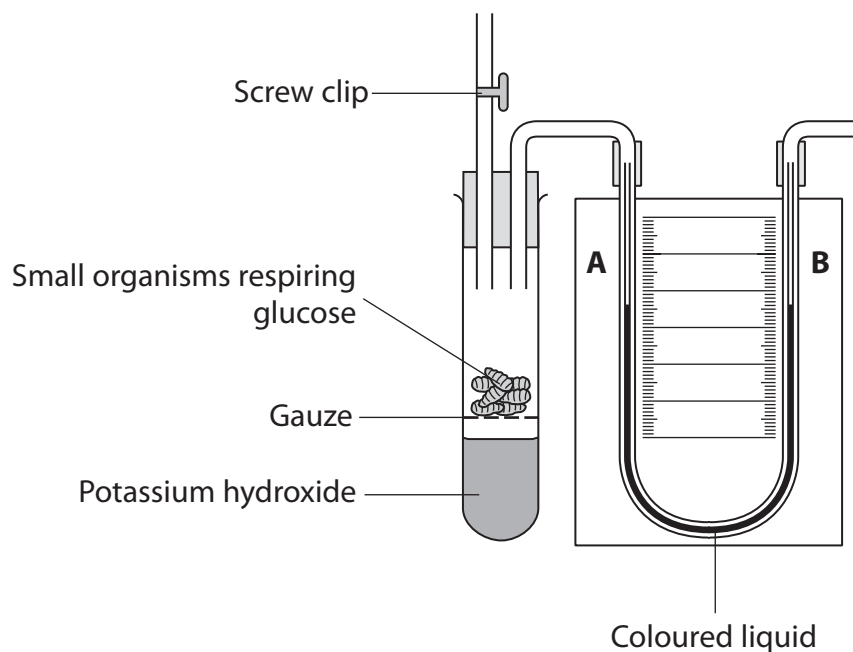
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(c) The diagram below shows a respirometer used to measure the rate of aerobic respiration in small organisms.



Potassium hydroxide absorbs carbon dioxide.

The table below describes three different situations.

Place a cross in the box ☒ that correctly shows the movement of the coloured liquid in the U-shaped tube for each situation.

(3)

Situation	Movement of coloured liquid		
	towards A	towards B	does not move
Screw clip is open	☒	☒	☒
Screw clip is closed	☒	☒	☒
Potassium hydroxide is replaced with water and screw clip is closed	☒	☒	☒

(Total for Question 4 = 13 marks)