

edexcel 

A2

Biology

**LATEST
SYLLABUS**



Unit 5: 2019 – 2025

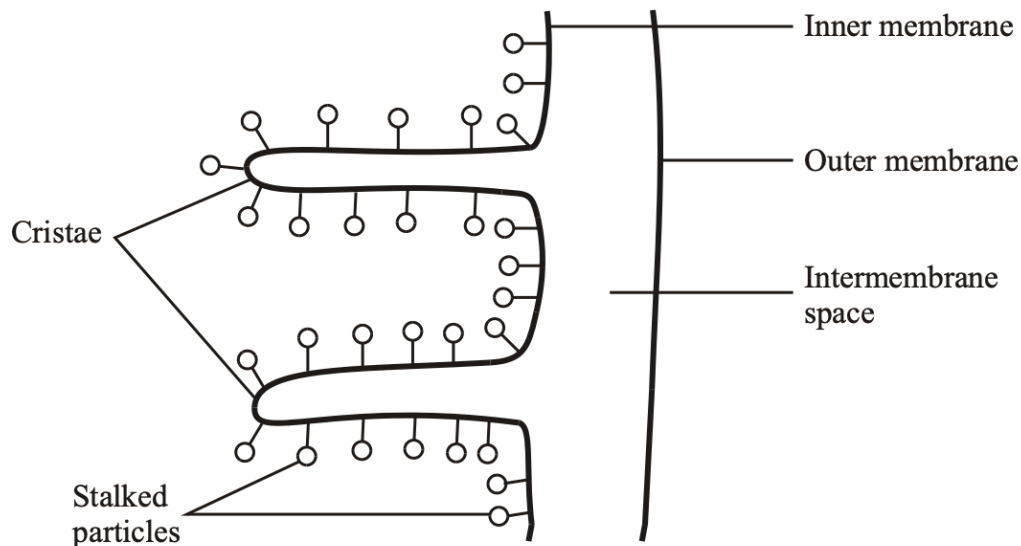
Classified Past PAPERS



SCAN ME



5. The diagram below shows a section through the membranes of a mitochondrion.



With reference to the structures labelled on the diagram, describe the role of the mitochondrial membranes in the production of ATP.

There is a compartmentalisation of processes that take place in the mitochondria

Membranes of mitochondria keep enzymes involved in the Krebs cycle within the matrix

The inner mitochondrial has cristae to increase its surface area, this is where the ETC is located

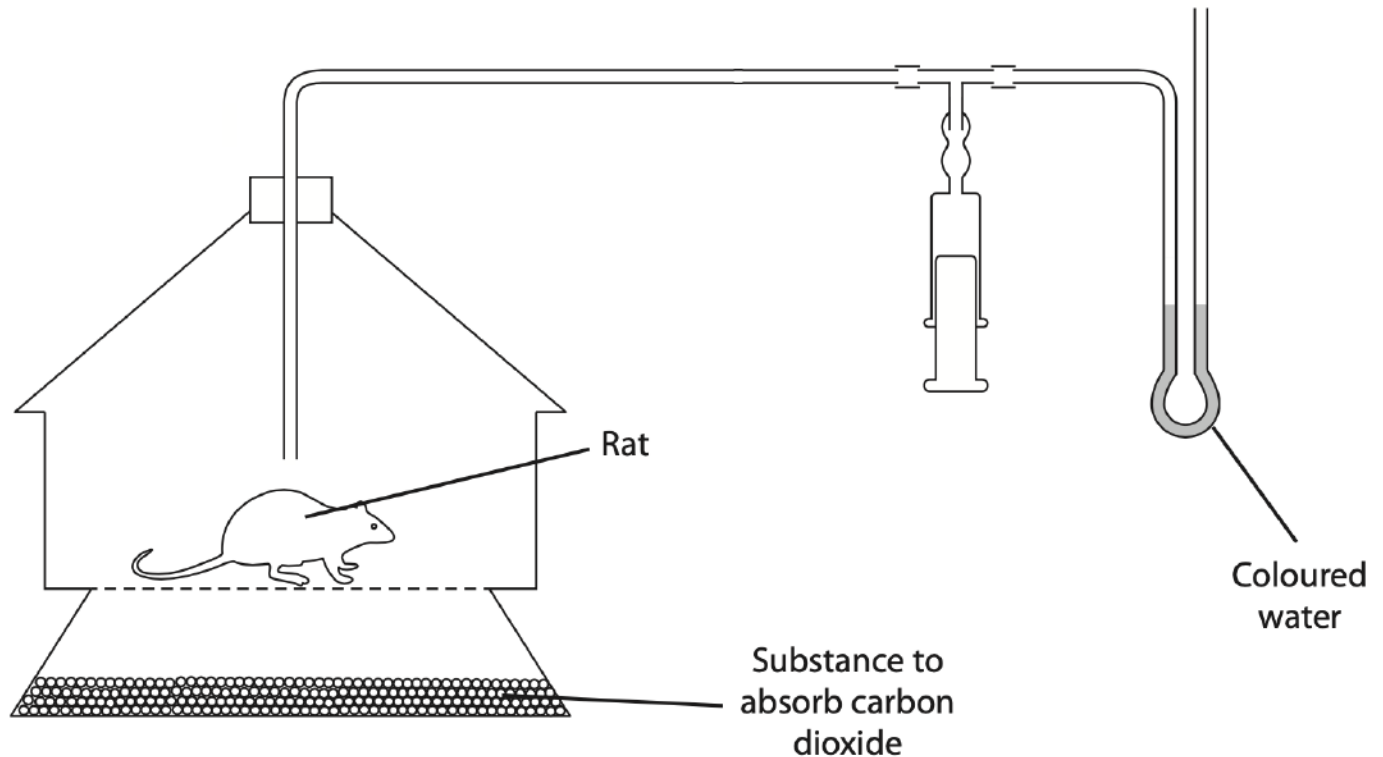
Both membranes are impermeable to hydrogen ions this helps to build an electrochemical gradient in the intermembrane space

The inner membrane contains ATP synthase

(Total 5 marks)

which provides a channel for the passage of hydrogen ions to the matrix, which helps to generate ATP by oxidative phosphorylation

- 1 The diagram below shows the apparatus that could be used to measure the respiration rate of a rat.



- *(a) Describe how this apparatus could be used to make a valid comparison of the respiration rates of male and female rats.

(6)

Obtain 10 male and 10 female rats

of the same age and same body mass

use a water-bath to control temperature

Measure the distance moved by the coloured water

Coloured water moves left because CO₂ is absorbed by NaOH

Over five minutes

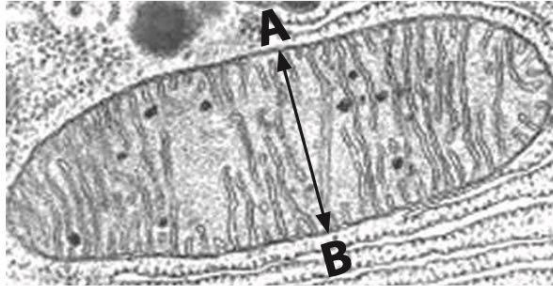
Calculate the rate of respiration by dividing the distance over time

Reset the position of the coloured liquid by using the syringe

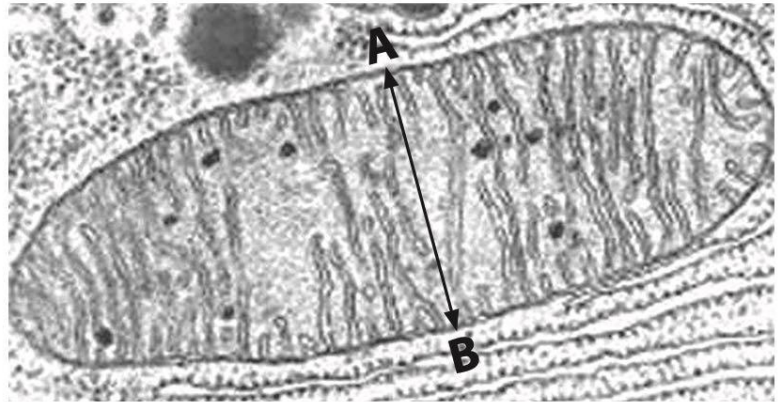
Repeat for the other rats and calculate the average for males and for females

- (b) The electron micrographs below show a typical mitochondrion in muscle before and after training.

Before training



After training



Magnification $\times 10\,000$

- (i) The width of each mitochondrion is shown by the line A to B.

Calculate the percentage change in the width of the mitochondrion after training. Show your working.

(2)

low value range of 2.1 to 2.2

high range value of 3.0 to 3.1

Answer between 36.36 and 47.61

Answer %

- (ii) The energy required for contraction of muscle fibres is provided by ATP. Describe how enough ATP is made available for contraction of this muscle fibre, despite there being only a few mitochondria.

(5)

ATP is made from the phosphorylation of ADP

The energy required for phosphorylation

comes from glycolysis in cytoplasm where glucose is split to pyruvate

Pyruvate is then converted to lactate during anaerobic respiration

NADH from glycolysis is oxidised by reducing pyruvate

ADP can also be phosphorylated by phosphocreatine

Some oxidative phosphorylation can take place in mitochondria

- (iii) Explain why you would expect this type of muscle fibre to fatigue quickly.

(2)

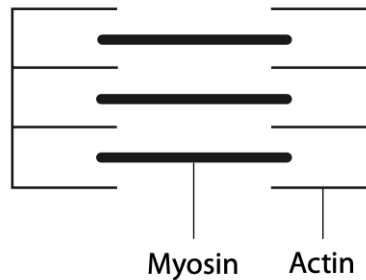
ATP supply is limited from anaerobic respiration

Lactate also lowers the pH

and affects enzyme activity preventing muscle contraction

(Total for Question 2 = 10 marks)

- (d) The diagram below shows the arrangement of actin and myosin myofilaments in part of an extended muscle.



Complete the diagram below to show accurately the arrangement of actin and myosin when the muscle is contracted.

(3)



- *(e) Describe and explain the role of calcium ions and ATP in muscle contraction.

(5)

The sarcoplasmic reticulum contains calcium ions
These ions bind to troponin which changes its shape
Causing tropomyosin to move exposing binding sites for myosin
ATP is required to remove calcium ions
And to change the shape of myosin
Which helps to break the cross bridges
ATP is also required for the synthesis of the neurotransmitter

(Total for Question 4 = 13 marks)

- (ii) The cellular levels of messenger RNA involved in the synthesis of actin change after landing on Earth.

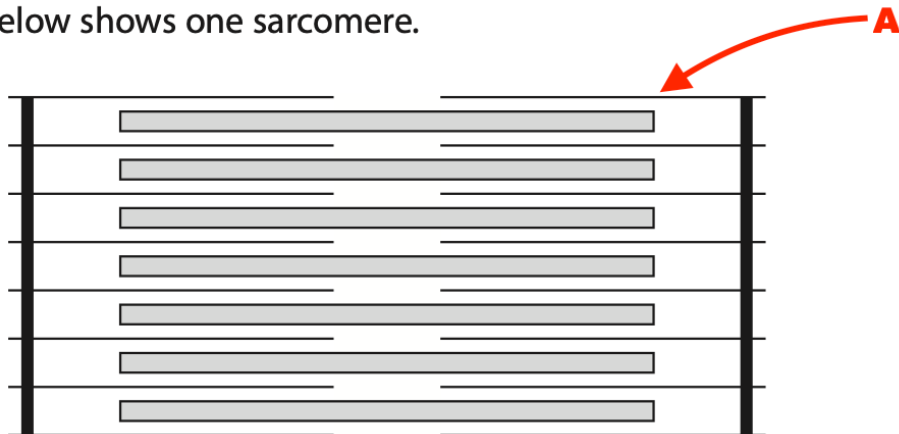
Suggest how this might explain the change in muscle volume between 4 days and 19 days after landing on Earth.

(2)

**The gene for actin switched on
causing an increased levels of transcription
and increased translation of the actin protein**

- (iii) Actin is a structural protein found in the sarcomeres of a muscle fibre.

The diagram below shows one sarcomere.



Draw a line, labelled A, to show the location of actin in this sarcomere.

(1)

- (iv) Actin has a role in muscle contraction.

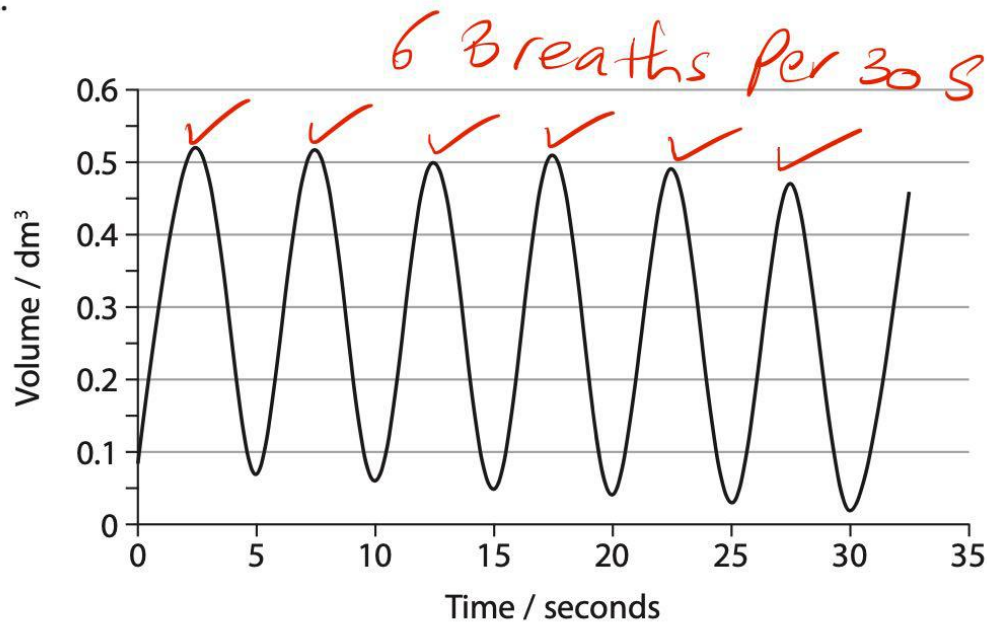
Name **two** structural proteins present in a sarcomere, other than actin, that have a role in muscle contraction.

(1)

myosin and troponin / tropomyosin

- (b) The respiratory system will also undergo physiological changes during a period of exercise.

The spirometer trace shown below was recorded when an adult was at rest. This trace can be used to calculate the resting breathing rate and tidal volume of the adult.



- (i) Place a cross in the box (☒) that correctly identifies the **approximate** value for resting breathing rate and tidal volume for this adult.

(2)

Approximate value for	0.1 dm ³	0.5 dm ³	6 dm ³ min ⁻¹	6 breaths min ⁻¹	12 breaths min ⁻¹
Resting breathing rate	☐	☐	☐	☐	☒
Resting tidal volume	☐	☒	☐	☐	☐

*(b) The treadmill test can be used to diagnose heart problems.

This test requires a person to walk on a treadmill whilst an electrocardiogram (ECG) is recorded.

The angle of the treadmill is raised to increase the level of exercise. The photograph below shows a person carrying out the treadmill test.



Explain how the heart rate of this person is controlled as the level of exercise increases during this test.

(6)

The increase in respiration rate in muscle cells

increase the levels of CO₂ and lactic acid in the blood

Chemoreceptors in medulla get stimulated

which causes the cardiovascular control centre in medulla to send impulses

through sympathetic nerves releasing noradrenaline onto the SAN

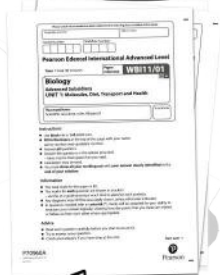
This causes the SAN excitation rate to be increased

resulting in an increased heart rate

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Videos that cover the entire syllabus

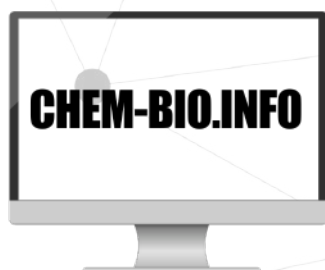
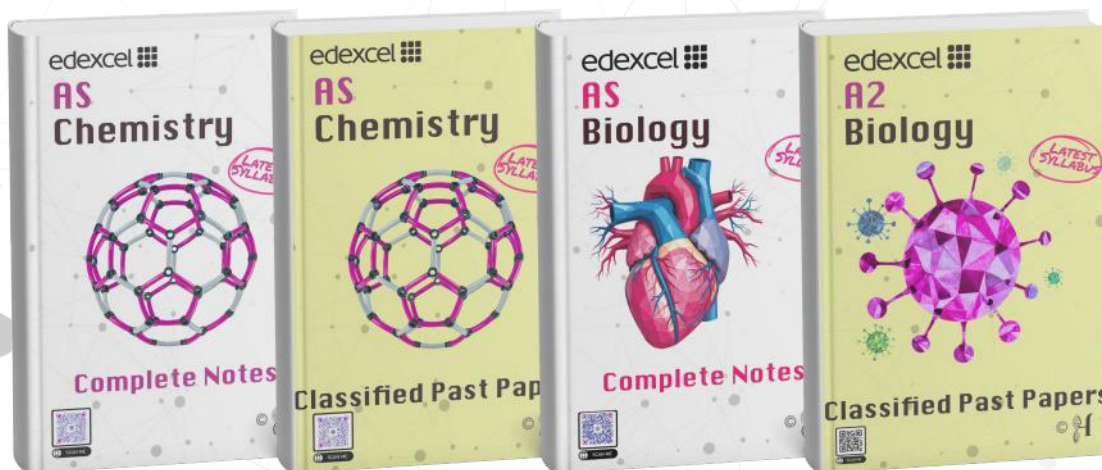


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