AQA – Organism exchange substances with their environment – A2 Biology P3

1. June/2020/Paper_3/No.6

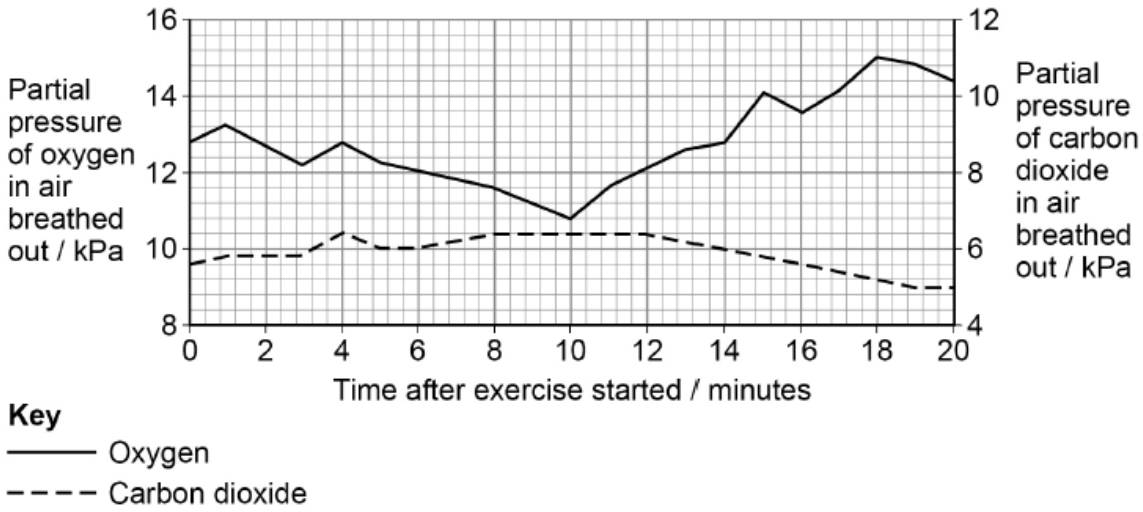
0 6 . 1 Describe the advantage of the Bohr effect during intense exercise.

[2 marks]

A cyclist completed a fitness test on an exercise bike. The intensity of the exercise was increased every 10 seconds. The test finished when he was unable to cycle any further. The partial pressure of oxygen (pO_2) and of carbon dioxide (pCO_2) in air breathed out was measured.

Figure 3 shows the results of the cyclist's fitness test.

Figure 3



Ventilatory threshold (VT) is a measure of the point when anaerobic respiration increases because aerobic respiration alone can no longer maintain muscle contraction.

0 6 . 2 VT can be identified as the **first** point when there is an increase in pO_2 breathed out, without an equivalent increase in pCO_2 breathed out.

Use **Figure 3** to determine the **time** after the exercise started when the cyclist reached VT.

Calculate the **ratio** of pO_2 to pCO_2 in breathed-out air at this time.

Show your working.

[2 marks]

Time when the cyclist reached VT = _____ min

Ratio of pO_2 to pCO_2 at VT = _____:1

0 6 . 3 An increase in the intensity of exercise produces an increase in the volume of carbon dioxide produced.

However, **Figure 3** shows that the pCO_2 in air breathed out did **not** show a large increase during the exercise.

Suggest **one** physiological change that would cause this result. Explain how the physiological change would allow for the removal of the increase in the volume of carbon dioxide produced.

[2 marks]

Physiological change _____

_____

Explanation _____

_____

_____

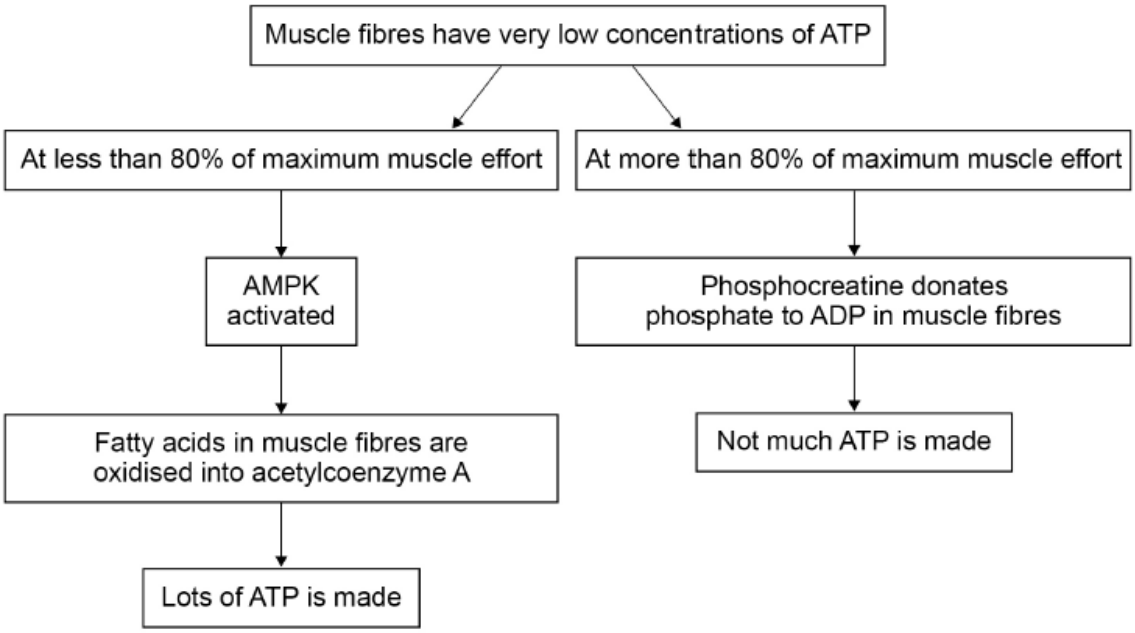
_____

When muscle fibres have very low concentrations of ATP, they may get ATP in the following ways.

- AMPK (an enzyme) oxidises fatty acids.
- Phosphocreatine donates phosphate to ADP in anaerobic conditions.

Figure 4 shows how these chemicals work.

Figure 4



0 6 . 4 At more than 80% of maximum muscle effort, ATP can only be made for a limited time.

Use **Figure 4** to suggest **one** reason why.

Tick (✓) the correct box.

[1 mark]

ATP cannot move into muscle fibres at a fast-enough rate. ☐

Muscle fibres have a limited amount of phosphocreatine. ☐

Muscle fibres produce too much lactate. ☐

Muscle fibres quickly run out of ADP. ☐

0 6 . 5 GW1516 is a performance-enhancing drug. GW1516 activates AMPK **and** develops slow muscle fibres at rest.

Use **Figure 4** to justify why professional athletes are **not** allowed to take GW1516.

Do **not** include details of chemiosmotic theory in your answer.

[4 marks]

EPO is another performance-enhancing drug. It can increase the haematocrit (the percentage of red blood cells in blood).

0 6 . 6 A heart attack is caused by a lack of glucose and oxygen being delivered to cardiac muscle via the coronary arteries. The overuse of EPO can increase the risk of a heart attack.

Suggest how.

[2 marks]

0 6 . 7 The normal haematocrit for human males is 47(±5)%. For professional male cyclists, the maximum haematocrit allowed is 50%.

A student suggested that professional male cyclists should be allowed to use EPO until their haematocrit is 50%.

Give **two** reasons why this suggestion is **not** valid.

[2 marks]

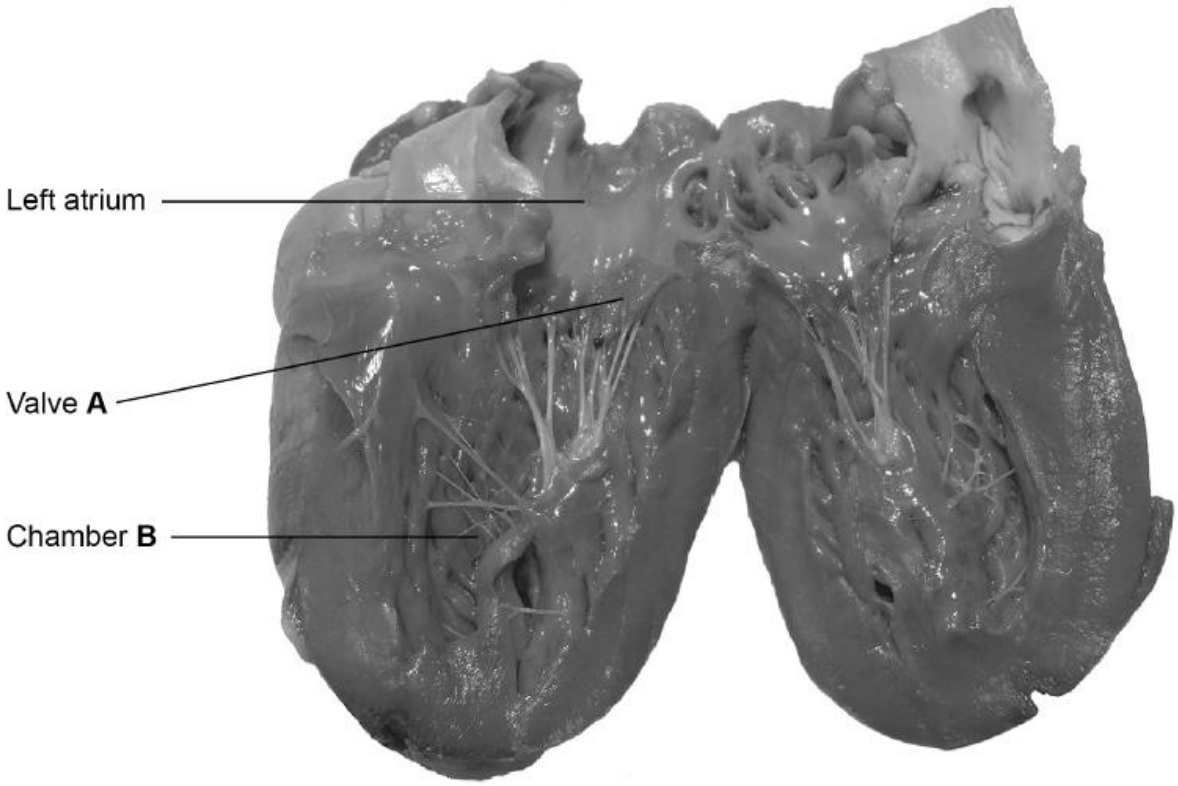
1

2

2. June/2019/Paper_3/No.3

0 3 **Figure 2** shows a photograph of a dissected heart.

Figure 2



0 3 . 1 Name valve **A** and chamber **B**.

[1 mark]

Valve **A** _____

Chamber **B** _____

0 3 . 2 Give **two** safety precautions that should be followed when dissecting a heart.

[1 mark]

1 _____

_____

_____

_____

2 _____

_____

_____

0 3 . 3 Explain how valve **A** in **Figure 2** maintains a unidirectional flow of blood.

[2 marks]

A research scientist investigated the effect of caffeine on heart rate in human volunteers.

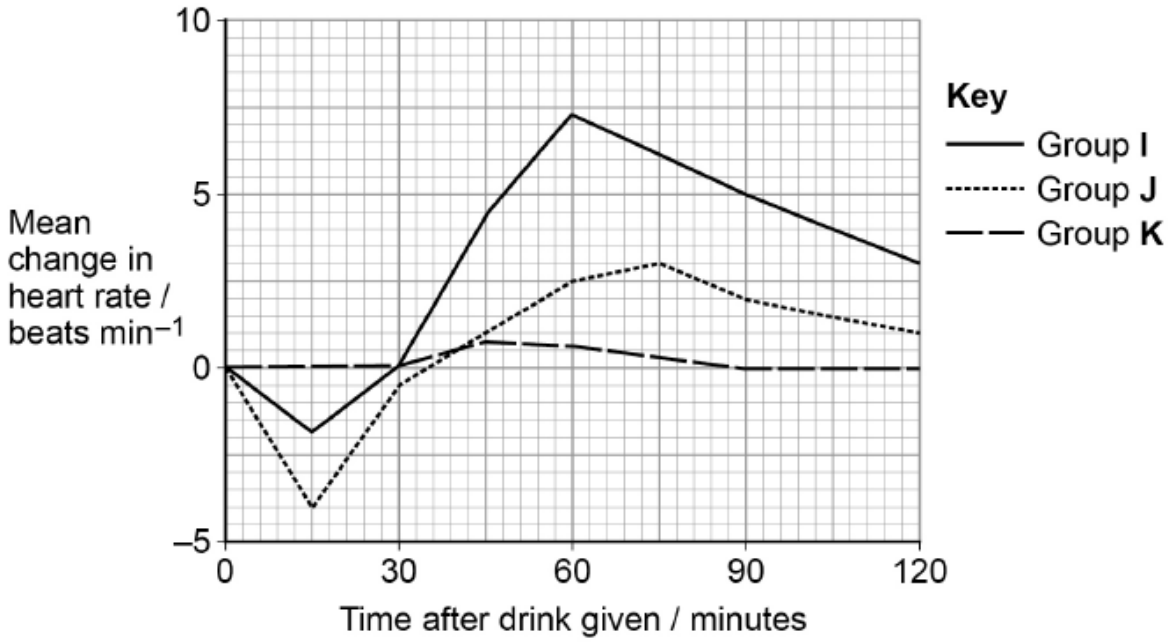
The scientist divided volunteers into three groups. Each group was given the same volume of fluid.

- Each member of Group **I** was given a sports drink containing caffeine and sugar.
- Each member of Group **J** was given a sports drink containing caffeine and no sugar.
- Each member of Group **K** was given water.

The scientist recorded the volunteers' heart rate before the drink was given and for 120 minutes after the drink was given.

Her results can be seen in **Figure 3**.

Figure 3



0 3 . 4 Caffeine affects the autonomic nervous system.

Suggest how caffeine could account for the results of Group **I** in **Figure 3** at 60 minutes.

[2 marks]

0 3 . 5 Before taking the drink, the mean heart rate of Group **J** was 68 beats per minute.

Fifteen minutes after taking the drink, the mean volume of blood leaving the hearts of Group **J** was 4700 cm^3 per minute.

Calculate the mean volume of blood leaving the heart at each beat fifteen minutes after taking the drink.

[1 mark]

Answer = _____ cm^3

0 3 . 6 The increase seen in Group **I** could be due to the combination of caffeine and sugar.

Suggest **one** drink to be given to an **additional** group that should be investigated to find out if this is true.

Give a reason for your answer.

[2 marks]

Group to be given _____

_____

_____

Reason _____

_____

_____

_____

_____

_____

_____