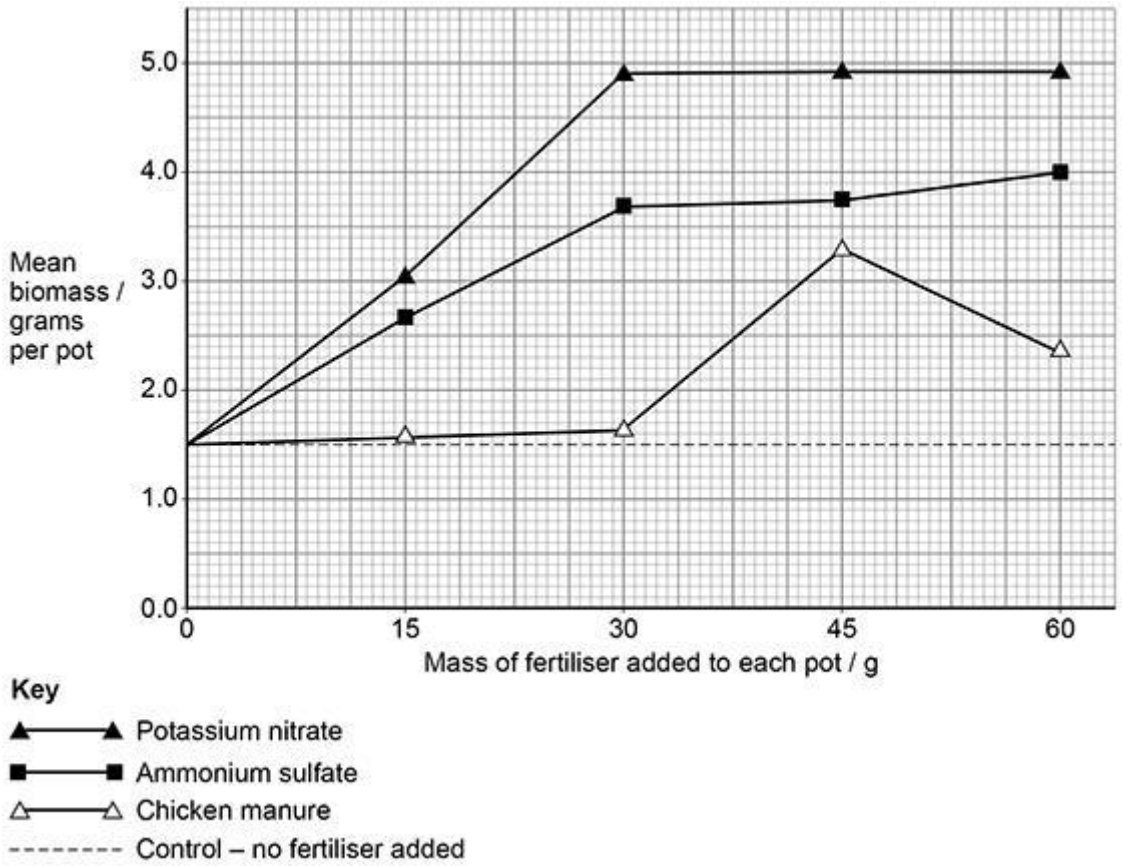
Name of the Student:_____
Max. Marks : 23 Marks **Time : 23 Minutes**

Q1.

A scientist investigated the effects of different fertilisers on the growth of spinach plants. The scientist:

- set up a large sample of identical pots of soil
- added different masses of different fertilisers to selected pots
- did not add fertiliser to the control pots
- planted the same number of young spinach plants in each pot
- after 20 days, determined the biomass of spinach plants in each pot.

The results the scientist obtained after 20 days are shown in the graph below.



(a) Calculate how many times greater the mean growth rate per day was using 37.5 g potassium nitrate than using 37.5 g ammonium sulfate.

Assume the mean biomass of the spinach plants at the start of the investigation was 0.5 g per pot.

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Answer _____

(1)

(b) Using all the information, evaluate the effect on plant growth of adding the different fertilisers to the soil.

_____

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(5)

(c) The scientist determined the dry mass of the spinach plants. First, he heated each sample at 80 °C for 2 hours.

Suggest what the scientist should do to ensure that he has removed all the water from the sample.

_____

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_____

(2)

(Total 8 marks)

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Q2.

(a) Describe the advantage of the Bohr effect during intense exercise.

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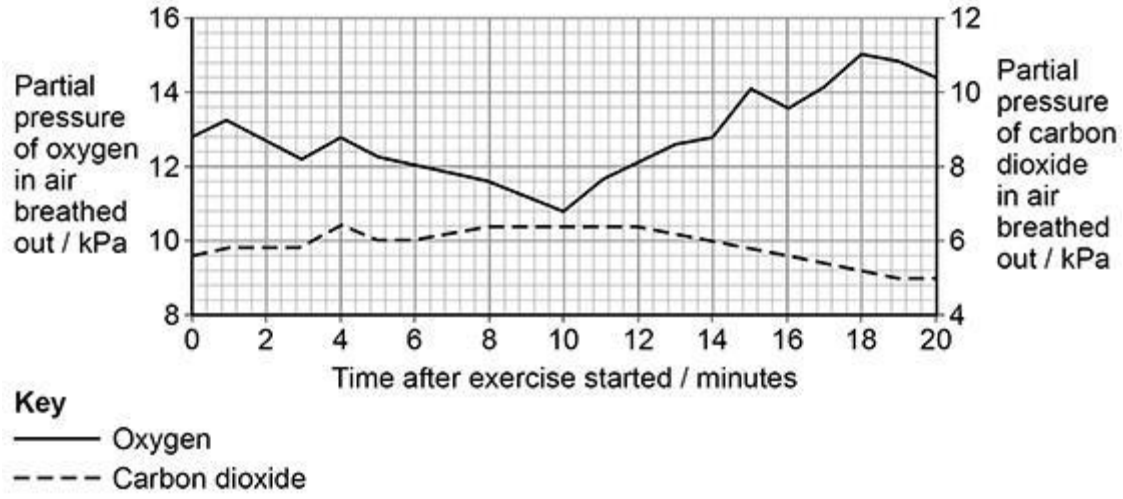
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(2)

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.

The graph below shows the results of the cyclist's fitness test.



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

(b) 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 the graph above 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.

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Time when the cyclist reached VT = _____ min

Ratio of pO_2 to pCO_2 at VT = _____ :1

(2)

(c) An increase in the intensity of exercise produces an increase in the volume of carbon dioxide produced.

However, the graph above 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.

Physiological change _____

_____

Explanation _____

_____

_____

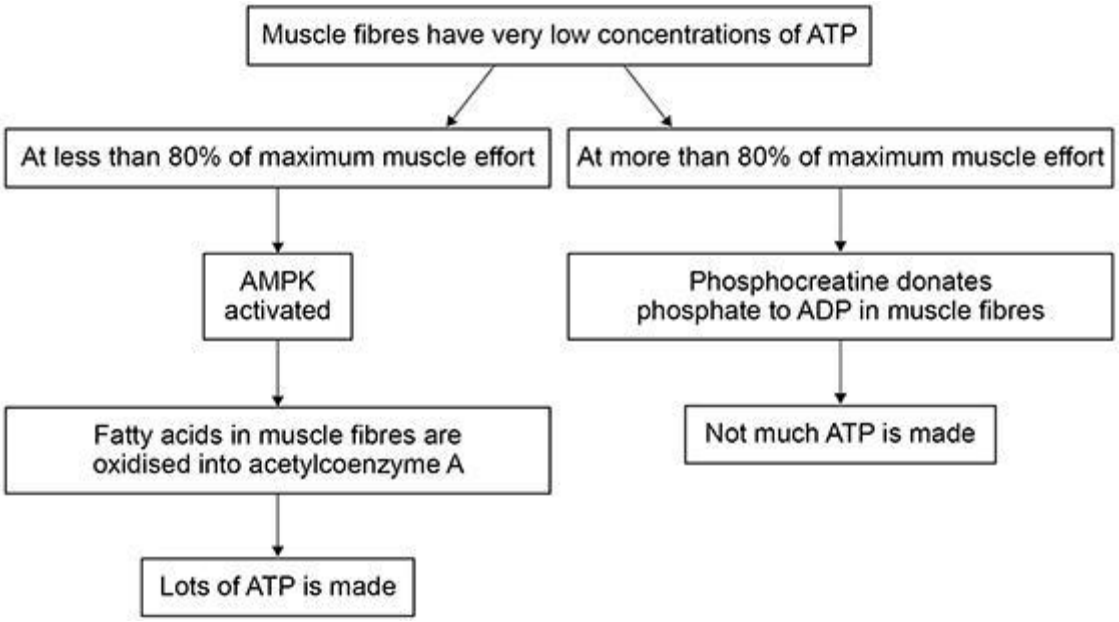
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(2)

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.

The diagram below shows how these chemicals work.



(d) At more than 80% of maximum muscle effort, ATP can only be made for a limited time.

Use the diagram above to suggest **one** reason why.

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Tick (✓) the correct box.

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.	☐

(1)

(e) GW1516 is a performance-enhancing drug. GW1516 activates AMPK **and** develops slow muscle fibres at rest.

Use diagram above to justify why professional athletes are **not** allowed to take GW1516.

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

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(4)

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

(f) 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.

_____

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(2)

(g) 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.

1 _____

_____

_____

2 _____

_____

_____

(2)

(Total 15 marks)

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