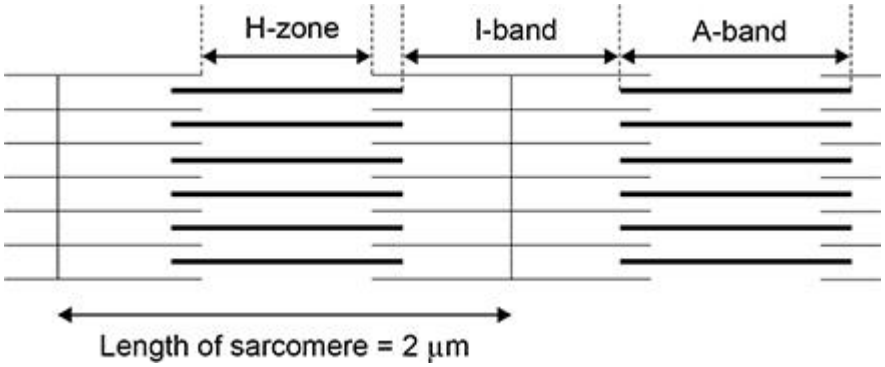
Q1.

(a) The figure below shows part of a relaxed myofibril.



The myofibril represented in the figure above has 34 sarcomeres.
The length of every sarcomere is 2 μm
After contraction of this myofibril, the length of each sarcomere changed by 20%.

Use the information provided to calculate the length of the myofibril after contraction.

Give your answer in mm and in standard form.

Show your working.

Answer _____ mm

(2)

(b) Which statement correctly describes the changes in length in a sarcomere when a myofibril contracts?

Tick (✓) **one** box.

H-zone decreases, I-band increases, A-band decreases	☐
H-zone increases, I-band decreases, A-band decreases	☐
H-zone decreases, I-band decreases, A-band no change	☐
H-zone increases, I-band increases, A-band no change	☐

(1)

(c) Fast muscle fibres have a higher concentration of glycogen than slow muscle fibres.

Explain how the difference in glycogen concentration is related to the different properties of these muscle fibres.

(4)

(Total 7 marks)

Q2.

Read the following passage.

ATP is essential for muscle contraction. The concentration of ATP in skeletal muscle is approximately 5×10^{-3} mmol g^{-1}. During maximum exercise, ATP in skeletal muscle is used at a rate of approximately 3.7 mmol kg^{-1} s^{-1}. If ATP was not resynthesised, maximum exercise would last a short time.

Some studies have suggested that taking creatine supplements can improve muscle performance during intense short-term exercise. Eating more carbohydrate, known as 'carbohydrate loading', for a few days before exercise can improve muscle performance when exercising for a long time.

During aerobic exercise, calcium ions in muscle cells have several roles. They activate the inclusion of glucose transport proteins, GLUT4, in the cell-surface membrane and the inclusion of fatty acid transport proteins, CD36, in mitochondrial membranes. An increase in muscle activity increases the concentration of carbon dioxide in the blood. This causes an increase in heart rate.

Use the information in the passage and your own knowledge to answer the following questions.

(a) ATP is essential for muscle contraction (line 1).

Describe the roles of ATP in muscle contraction.

_____

_____

_____

_____

_____

_____

(2)

(b) Calculate how long maximum exercise would last if ATP was not resynthesised (lines 3–4).

Answer _____ s

(1)

(c) Describe and explain how taking creatine supplements (lines 5–6) and 'carbohydrate loading' (lines 6–7) can improve performance of different types of muscle fibres during different types of exercise.

(5)

(d) Suggest and explain how GLUT4 and CD36 transport proteins (lines 10–11) are beneficial during exercise.

(3)

(e) An increase in muscle activity causes an increase in heart rate (lines 12–14).

Describe and explain how.

(4)

(Total 15 marks)