

- 1 The giraffe is the tallest mammal and has a long neck.

The photograph shows a giraffe.



(Source: © Eugen Haag/Shutterstock)

- (a) (i) Which structure joins the bones of the neck together?

(1)

- ☐ A actin
☐ B ligament
☐ C muscle
☐ D tendon

- (ii) Which structure joins a muscle to a bone?

(1)

- ☐ A actin
☐ B ligament
☐ C myosin
☐ D tendon

- (iii) Which chemical group contains actin and myosin?

(1)

- ☐ A carbohydrates
☐ B fatty acids
☐ C nucleic acids
☐ D proteins

- (b) Giraffes must bend down to drink water.



knee joint

(Source: © Wim Hoek/Shutterstock)

- (i) Explain how the knee joint can be held steady in this position as the giraffe drinks.

(2)

- (ii) Describe the role of ATP in the sliding filament theory of muscle contraction.

(3)

(Total for Question 1 = 8 marks)

1 Skeletal muscle is made of bundles of fibres.

(a) Describe the role of calcium ions in producing contraction of a muscle fibre.

(2)

(b) The table shows some features of slow and fast twitch muscle fibres.

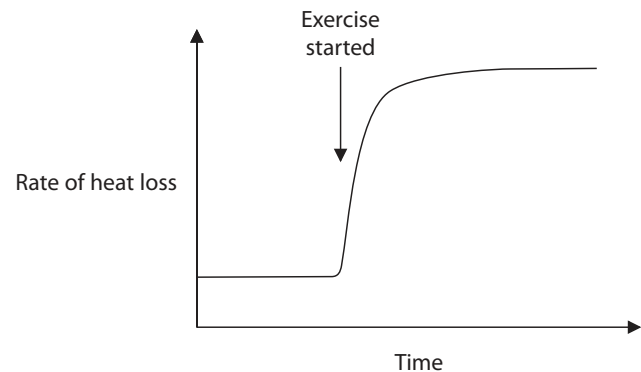
Feature of fibre	Slow twitch fibre	Fast twitch fibre
Number of mitochondria per fibre	Many	Few
Number of myoglobin molecules per fibre	Many	Few
Capillary network	Larger	Smaller
Contraction	Slow and sustained	Rapid and intense

Olympic marathon runners have a high proportion of slow twitch fibres in their muscles.

Explain how the features of slow twitch fibres, shown in the table, are of benefit to an Olympic marathon runner.

(4)

(c) The graph shows the rate of heat loss at rest and during exercise.



Comment on the rate of heat loss during exercise.

(2)

(Total for Question 1 = 8 marks)

3 Many of the metabolic processes taking place in cells require ATP.

(a) The electron transport chain (ETC) is involved in the production of ATP.

(i) Where is the site of the electron transport chain?

(1)

- ☐ A cytoplasm
- ☐ B inner mitochondrial membrane
- ☐ C mitochondrial matrix
- ☐ D outer mitochondrial membrane

(ii) Enzymes are involved in the production of ATP by the electron transport chain.

Which type of molecule is an enzyme?

(1)

- ☐ A carbohydrate
- ☐ B lipid
- ☐ C phospholipid
- ☐ D protein

(iii) Describe the role of reduced NAD in aerobic respiration.

(2)

(b) Carbon monoxide and cyanide affect the production of ATP.

(i) Carbon monoxide binds to the haem group of haemoglobin.

Explain how carbon monoxide will affect the production of ATP.

(3)

(ii) Cyanide stops the transfer of electrons along the electron transport chain.

Explain why cyanide does not affect the production of ATP from anaerobic respiration.

(2)

(Total for Question 3 = 9 marks)

4 Muscles, bones and joints enable movement of the skeleton.

(a) (i) Which structure attaches one bone to another bone at a flexible joint?

(1)

- ☐ A actin
- ☐ B ligament
- ☐ C synapse
- ☐ D tendon

(ii) How many of the statements about joints are correct?

(1)

- antagonistic pairs of muscles move the bones at a joint
- muscles acting on a joint are myogenic
- tendons are more elastic than ligaments

- ☐ A 0
- ☐ B 1
- ☐ C 2
- ☐ D 3

(b) Usain Bolt's world record of 9.58 seconds for the 100 m men's sprint is unbeaten.



(Source: © Ian MacNicol / Getty Images)

(i) What is the role of myoglobin in muscle fibres?

- ☐ A it is an enzyme that reacts with myosin
- ☐ B it is part of the sarcolemma involved in the release of calcium ions
- ☐ C to act as an immediate source of energy
- ☐ D to provide oxygen for muscles

(1)

(ii) Explain why the muscles of a sprinter have a high percentage of fast twitch fibres.

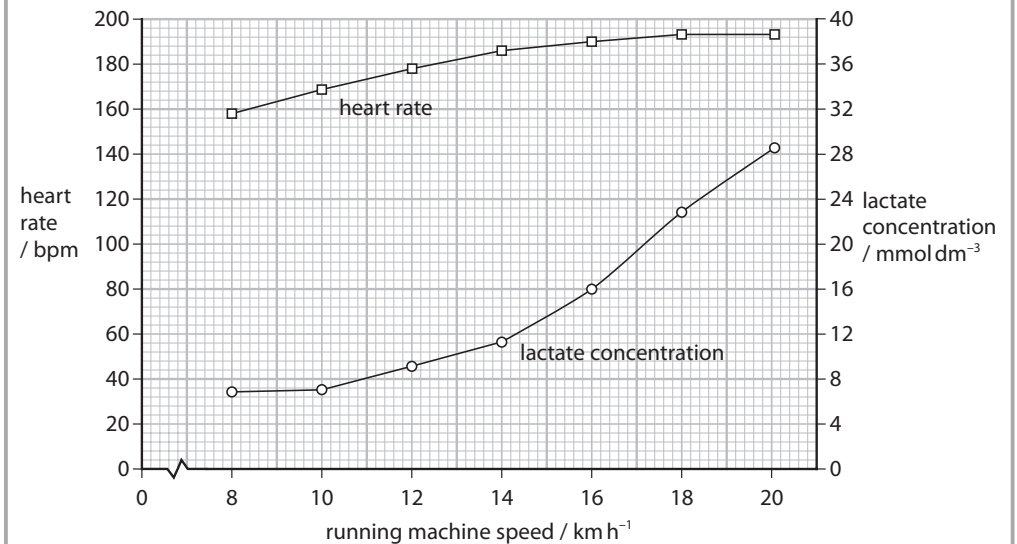
(3)

(c) In an investigation, an athlete ran for 10 minutes on a running machine moving at constant speed.

The investigation was repeated at seven running speeds.

At each speed, the heart rate and lactate concentration in the blood of the athlete were measured.

The results are shown in the graph.



Comment on the results of this investigation.

(3)

(Total for Question 4 = 9 marks)