

11.2 Movement

Question Paper

Course	DP IB Biology
Section	11. Animal Physiology (HL Only)
Topic	11.2 Movement
Difficulty	Medium

Time allowed: 60
Score: /47
Percentage: /100

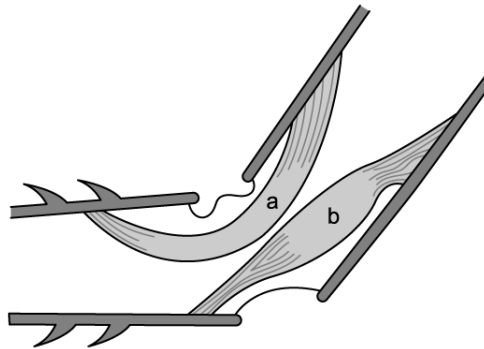
Question 1a

a)
Compare and contrast bones and exoskeletons.

[3 marks]

Question 1b

b)
The image below shows two muscles in the leg of a jumping insect.



Describe the roles of muscles **a** and **b** in altering the insect's leg position.

[2 marks]

Question 1c

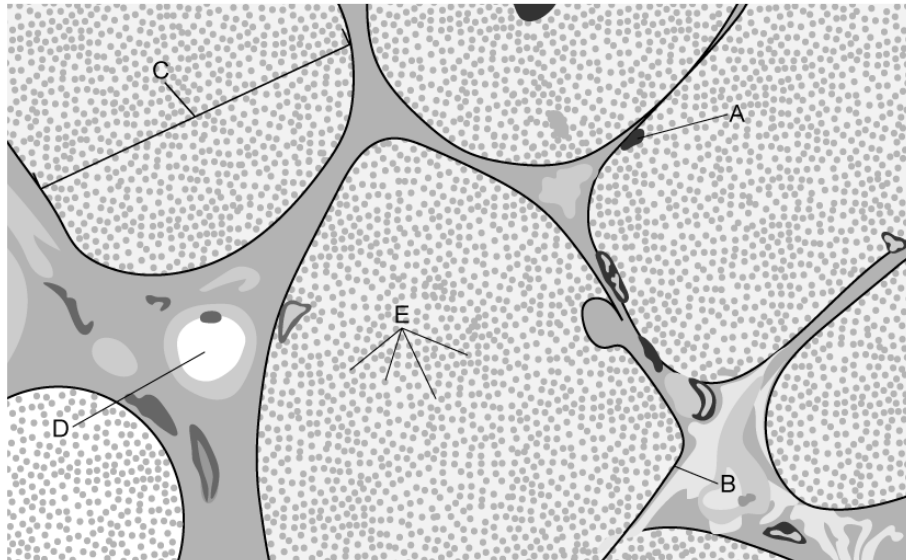
c)
Explain how this would be different for the equivalent muscles in the arm of a human.

[3 marks]

Question 2a

a)

The image below shows an electron micrograph cross section through a skeletal muscle.



Identify structures **A–C** labelled in the image above.

[3 marks]

Question 2b

b)

The structures labelled **E** in the image in part a) are called myofibrils.

Describe the structure of a myofibril.

[2 marks]

Question 2c

c)
The structure labelled **C** in the image in part a) is 30 mm long when relaxed, but only 22.5 mm long when contracted.

Calculate the percentage decrease in length of the contracted structure **C**.

[2 marks]

Question 2d

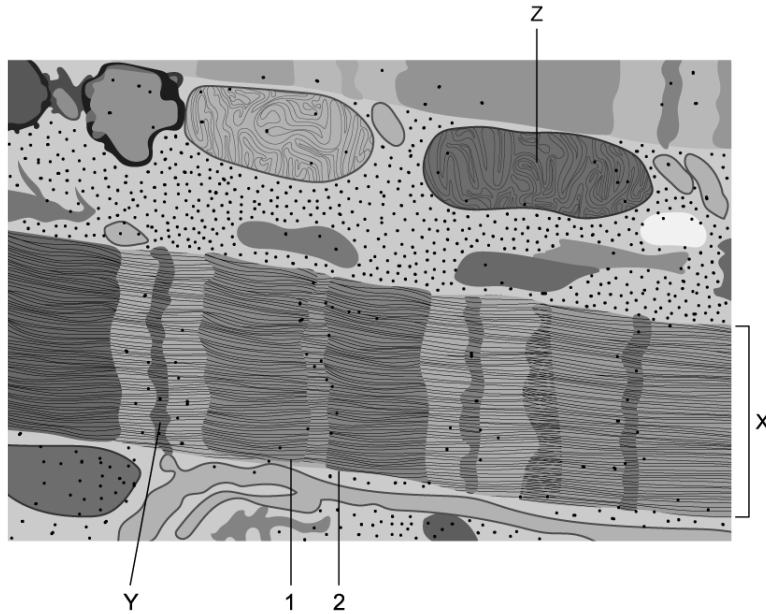
d)
Suggest **two** reasons why it may be beneficial to study skeletal muscle fibres using an electron microscope rather than an optical microscope.

[2 marks]

Question 3a

a)

The image below is a transmission electron micrograph of a longitudinal section of skeletal muscle.



Identify structures **X**, **Y** and **Z**.

[3 marks]

Question 3b

b)

Identify the molecules present in the regions labelled **1** and **2** in the image in part a).

[1 mark]

Question 3c

c)

During intense exercise the pH of skeletal muscle tissue falls sharply, causing alterations in the 3D structure of some calcium receptors within muscle fibres and lowering their contractile ability.

Use the information provided and your own knowledge to explain the reduced contractile ability of muscle fibres that results from intense exercise.

[3 marks]

Question 4a

a)

The table below describes three molecules involved with muscle contraction.

Identify molecules **A–C** below.

Description	Molecule
Attaches to M line at the centre of the sarcomere	A
Hydrolysis of this molecule is required for the recovery stroke	B
Ion that diffuses across the sarcolemma	C

[3 marks]

Question 4b

b)

Outline how the filaments within muscle fibres slide past each other in the sliding filament mechanism of muscle contraction.

[2 marks]

Question 4c

c)

A recent discovery has shown that a third protein filament, known as titin, is also present in muscle fibres. The role played by titin is still being investigated, but one study looked at the effects of removing titin from the muscles of mice.

To remove the titin protein the mice had their muscles modified so that their titin filaments contained a cutting site for a plant enzyme called TEV protease. This meant that the scientists could use TEV protease to cut the titin proteins.

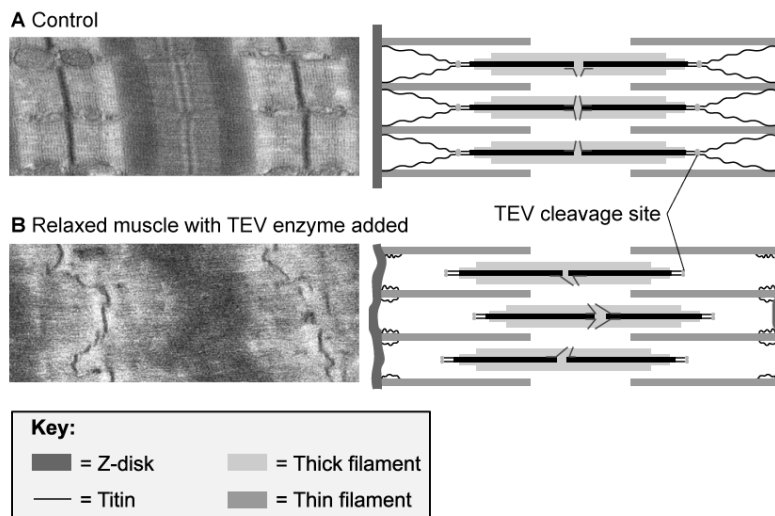
Suggest why the plant enzyme TEV protease was used rather than an animal protease.

[2 marks]

Question 4d

d)

The image below shows the location of titin within the sarcomere, as well as some of the results gained from the study described in part c) above.



Use the image and your existing knowledge to suggest a possible function of titin filaments.

[1 mark]

Question 5a

One mark is available for clarity of communication throughout this question.

a)

Draw a labelled diagram of a sarcomere.

[5 marks]

Question 5b

b)

Describe the mechanism of muscle contraction from the point at which myosin binds to actin.

[7 marks]

Question 5c

c)

Explain how fluorescent dye can be used to show the role of ATP in muscle contraction.

[3 marks]