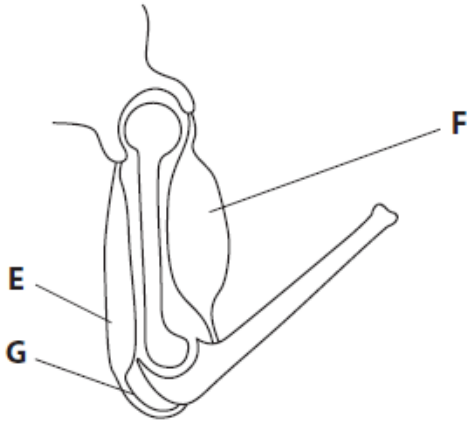
Q1.

Movement of the arm at the elbow joint results from the contraction of muscles.

The diagram shows some of the structures in a human arm.



(a) Give the term for a pair of muscles that brings about movement at a joint.

(1)

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(b) (i) Give a reason why **F** can be described as a flexor muscle.

(1)

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(ii) Describe how **G** interacts with **E** to enable movement at this joint.

(2)

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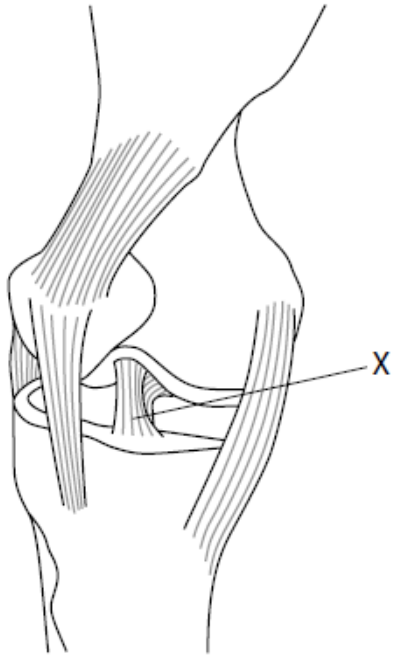
Q2.

Movement at a joint is brought about by the contraction of antagonistic muscles which contain slow and fast twitch fibres.

The diagram shows a knee joint.



Lateral view of the knee

(a) Which tissue is used to repair structure X using keyhole surgery?

(1)

☒ **A** bone

☒ **B** cartilage

☒ **C** ligaments

☒ **D** tendon

(b) Explain why muscles occur in antagonistic pairs.

(2)

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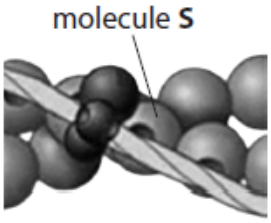
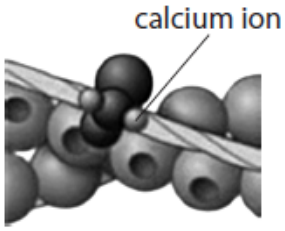
(Total for question = 3 marks)

Q3.

Muscle cells contain myofibrils. The diagrams show the arrangement of some of the molecules present in a myofibril when calcium ions are absent and when they are present.



calcium ions absent



calcium ions present

(i) Describe the changes caused when calcium ions bind to the molecules shown in the diagram.

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(ii) Explain how these changes cause muscles to contract.

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(Total for question = 6 marks)

Q4.

The photograph shows a female gymnast on a narrow beam.

(a) The table below refers to two regions of the brain.

Complete the table by describing **one** role of each region of the brain, while she is on the beam.

(2)

Region of the brain	One role while she is on the beam
Cerebellum	
Medulla oblongata	

(b) This gymnast will generate a lot of heat while she is on the beam.

Describe and explain how changes in blood flow in the skin will help her to control her body temperature.

(4)

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(c) Gymnasts can damage their cruciate ligaments. This is an injury that can be repaired using keyhole surgery.

(i) Explain what is meant by the term **cruciate ligament**.

(2)

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(ii) A gymnast was offered keyhole surgery to repair her damaged cruciate ligament.

Suggest and explain **two** reasons why she might choose this type of surgery.

(2)

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(Total for question = 10 marks)

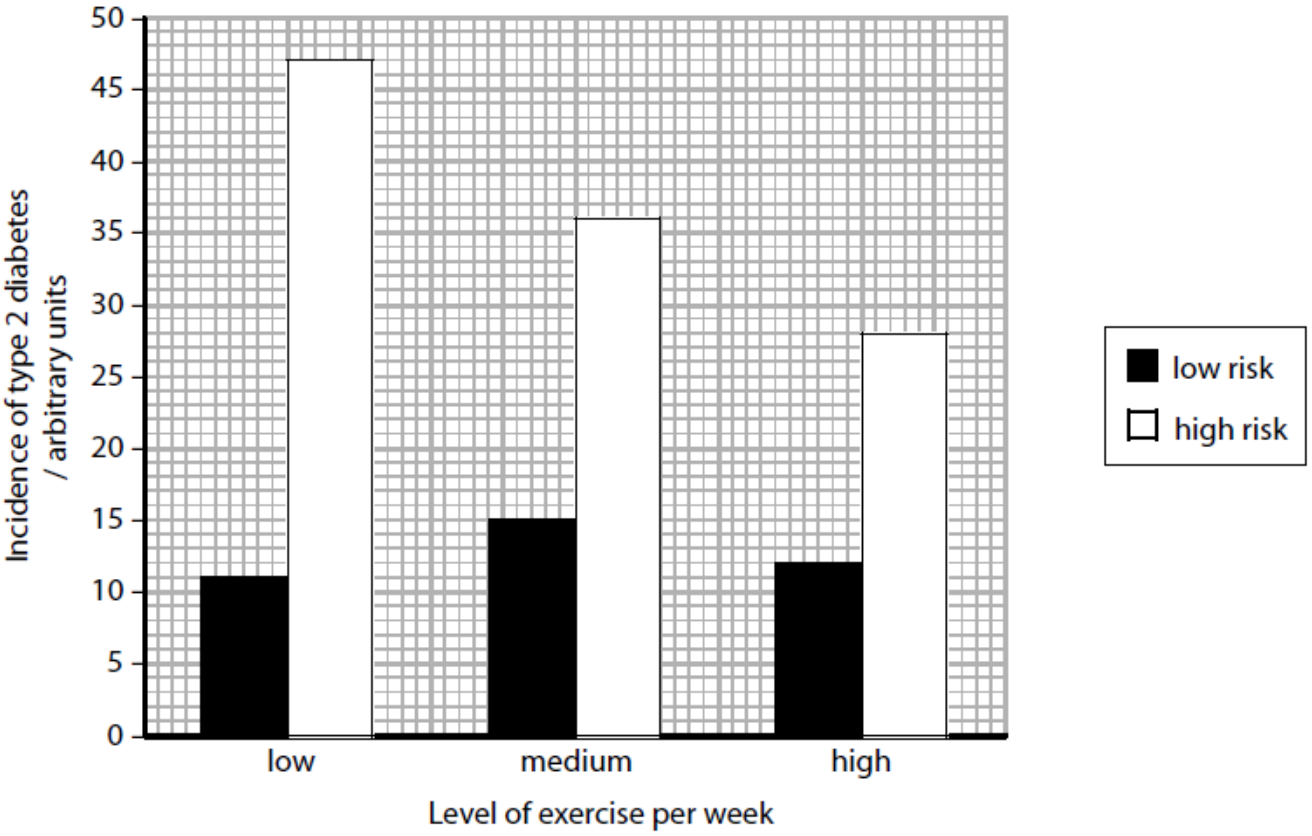
Q5.

The development of type 2 diabetes may be linked to lack of exercise.

The graph below shows the effect of exercise on the incidence of type 2 diabetes in two groups of men.

Men at low risk had no family history of developing type 2 diabetes. Men at high risk had a family history of developing type 2 diabetes.

The men were grouped according to their level of exercise per week.



Analyse the data to discuss possible correlation and causation in the relationship between the incidence of type 2 diabetes and the level of weekly exercise.

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(Total for question = 4 marks)

Q6.

Dark chocolate contains a chemical called epicatechin.

An investigation was carried out to study the effect of epicatechin on mice.

Three groups of one-year-old male mice, group A, group B and group C, were used in an investigation lasting 15 days.

The table below shows how each group of mice was treated.

Group	Epicatechin added to drinking water	Extra exercise
A	Yes	No
B	No	No
C	No	Yes

All other variables were kept constant and after 15 days skeletal muscle from the mice in each group was studied.

(a) The ability of the skeletal muscle to contract was compared. The time taken for the muscle to start to fatigue (fail to contract) was recorded.

The results are shown in the table below.

Group	Time taken for skeletal muscle to fatigue / seconds	
	Mean	Range
A	164	± 10
B	130	± 4
C	128	± 5

A statistical test was carried out on the results.

The test showed that the addition of epicatechin had a significant effect on the time taken for mouse skeletal muscle to fatigue. The test also showed that extra exercise had no significant effect.

Use the results table to supply evidence that the addition of epitcatechin had a significant effect but extra exercise had no effect.

(4)

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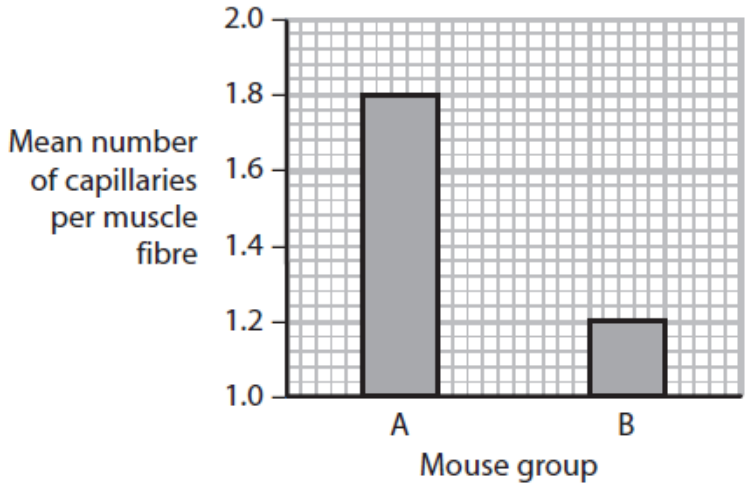
(b) The mean number of capillaries per muscle fibre was found for the skeletal muscle from groups A and B.

The bar chart below shows the results.



(i) Use the information in the bar chart to describe the effect of epicatechin on the mean number of capillaries per muscle fibre.

(2)

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*(ii) Using your knowledge of respiration and the results table for groups A and B, suggest an explanation for the effect of the change in the numbers of capillaries on the time taken for the muscle to fatigue.

(5)

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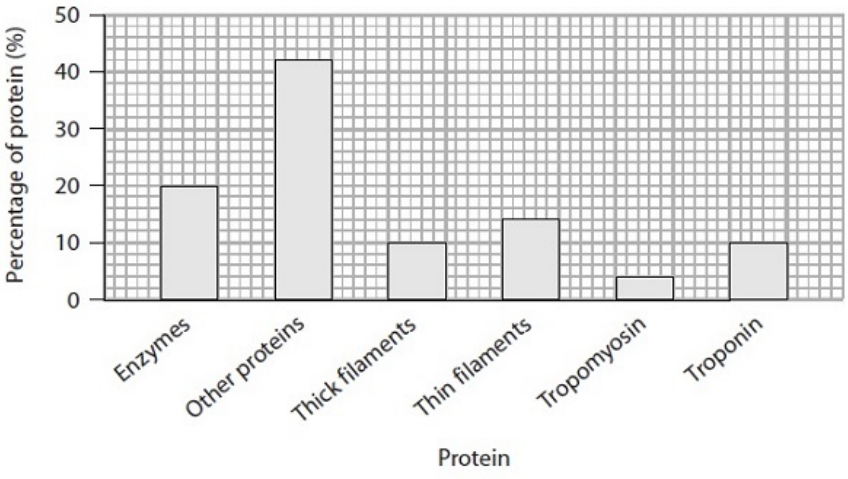
(Total for question = 11 marks)

Q7. Skeletal muscle and cardiac muscle have some of the same proteins.

(a) The percentage of the proteins found in cardiac muscle are shown in the bar chart below.



(i) Using the information in the bar chart, give the percentage of protein that is actin and the percentage that is myosin.

(2)

Actin:
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%

Myosin:
.....%

(ii) Describe how calcium ions affect troponin as a skeletal muscle fibre contracts.

(2)

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(iii) Some of the 'other proteins' shown in the bar chart are found in the sinoatrial node (SAN).

State the location of the SAN in the heart.

(1)

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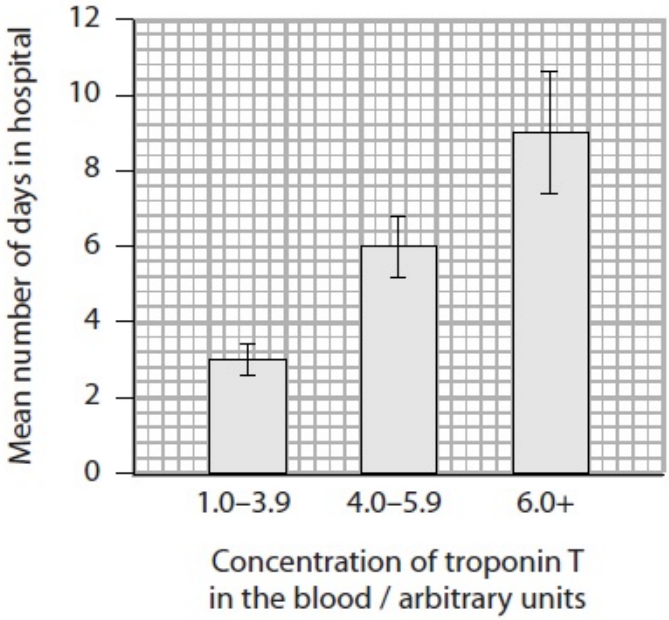
(b) Troponin T is found in cardiac muscle cells. It can leak into the blood if the heart is damaged as a result of cardiovascular disease (CVD).

Testing for troponin T in blood can be used to study patients with CVD.

The graph below shows the concentration of troponin T in the blood of patients with CVD.

The graph also shows the mean number of days and the range of time spent in hospital.



(i) Suggest a conclusion that a doctor could draw from these data.

(1)

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(ii) Comment on the validity of the doctor's conclusion.

(2)

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(Total for Question = 8 marks)

Q8.

A number of drugs, including EPO, have been used by athletes.

EPO is a drug that stimulates the formation of red blood cells. EPO has been used to enhance the performance of certain types of athlete.

Suggest **two** ethical reasons why the use of drugs, such as EPO, should be banned from sport.

(2)

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