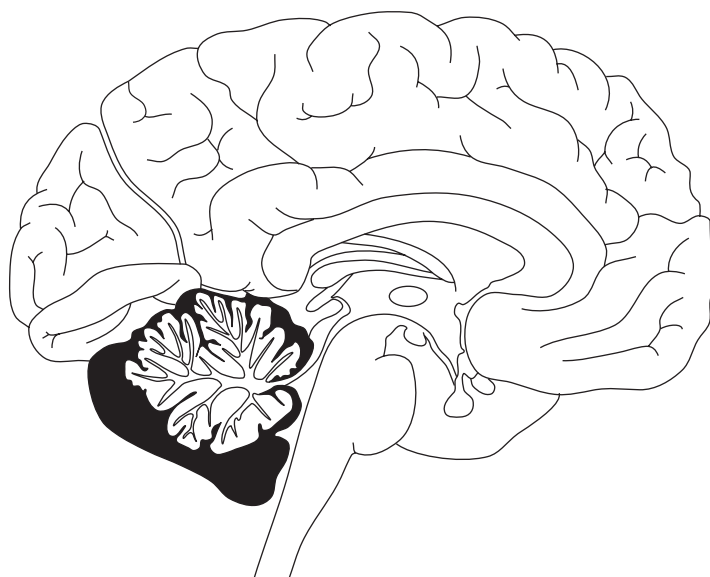


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Answer ALL questions in the spaces provided.

1. The diagram below shows a vertical section through a human brain.



(a) On the diagram, draw an arrow to show the position of the **hypothalamus**. **(1)**

(b) The forebrain, midbrain and hindbrain are the three main regions of the human brain.

State in which region of the brain the hypothalamus is found.

..... **(1)**

(c) Give **two** functions of the hypothalamus.

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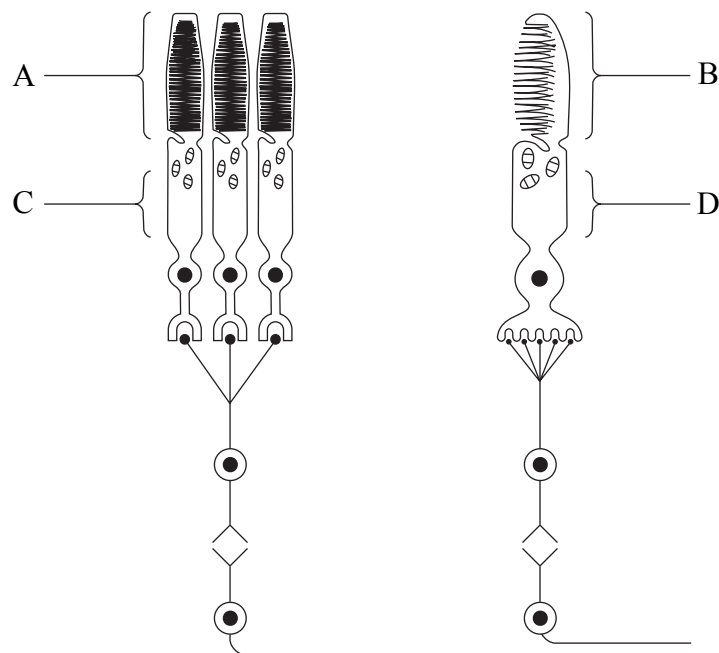
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(2) **Q1**

(Total 4 marks)



2. The diagram below shows a section through part of a mammalian retina.



(a) (i) State which of the parts labelled A, B, C or D, contains **iodopsin**.

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(1)

(ii) There are three different forms of iodopsin. State how many different forms of iodopsin would be present in the cells shown in the diagram.

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(1)



(b) Explain how **rhodopsin** is involved in the conversion of light energy into electrical energy.

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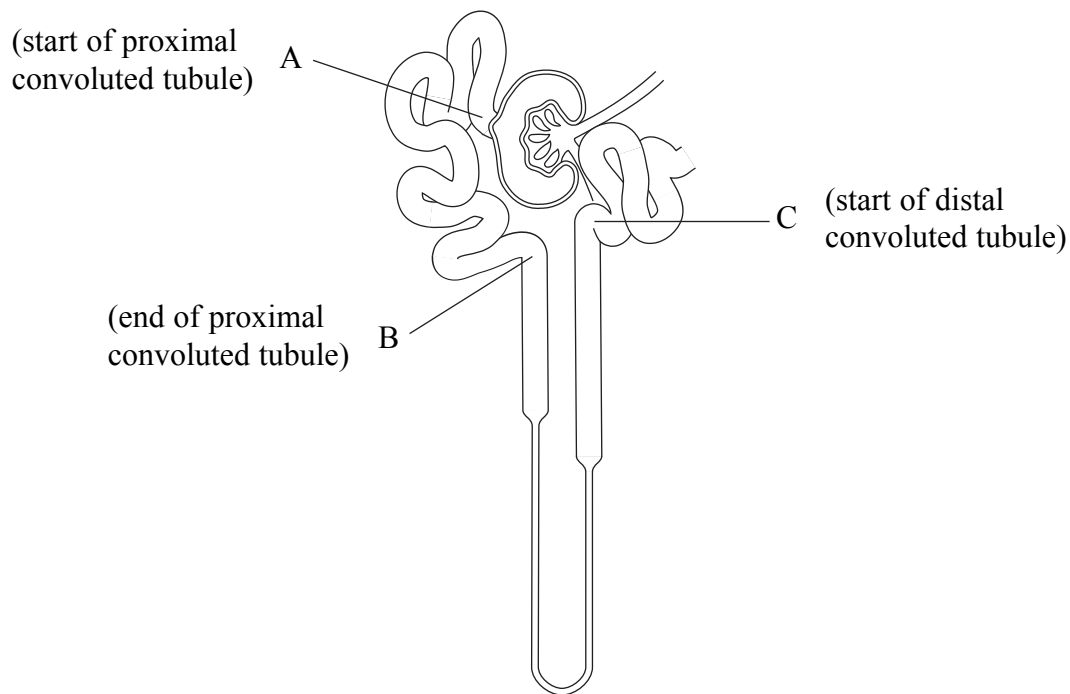
(4) Q2

(Total 6 marks)

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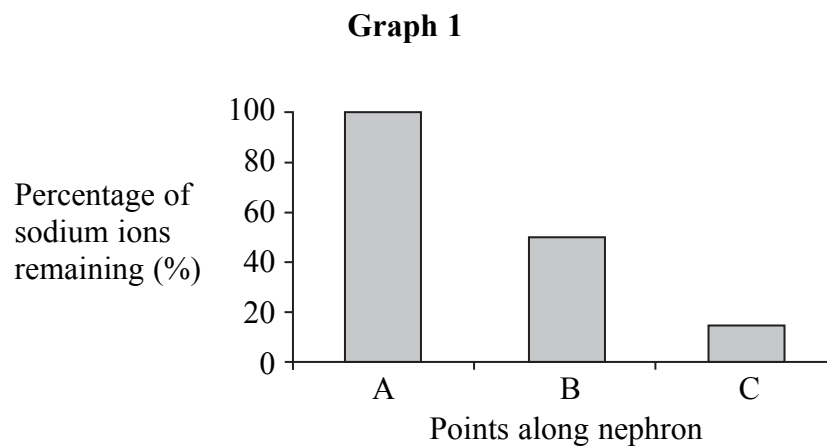


3. The diagram below shows a kidney tubule (nephron).



Ultrafiltration in the Bowman's capsule produces a filtrate that contains sodium ions. The sodium ion content of the filtrate changes as it passes along the nephron. The sodium ion content was measured at three points A, B and C along the nephron.

Graph 1 below shows the percentage of sodium ions remaining in the filtrate at points A, B and C.



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(a) Explain the reasons for the decreases in sodium ion content in the two regions below.

A to B

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B to C

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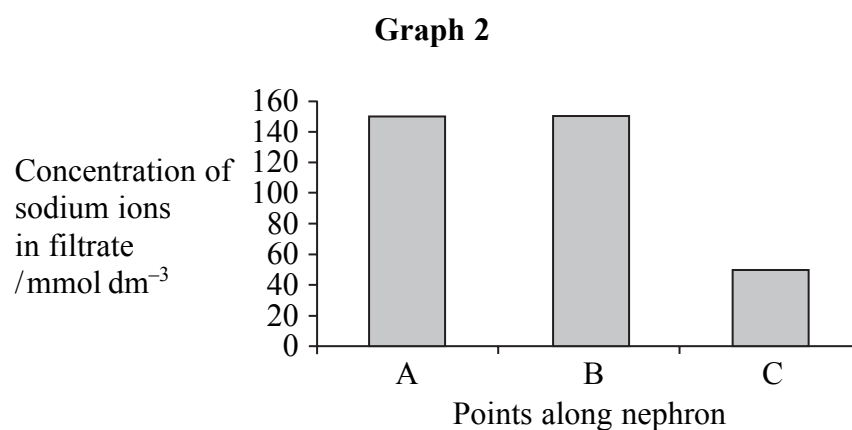
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(3)



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(b) Graph 2 shows the **concentration** of sodium ions in the same filtrate at points A, B and C.



Explain why there is no change in concentration of sodium ions in the filtrate, between points A and B.

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(2)



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(c) Describe the effect that an increase in secretion of ADH from the pituitary gland would have on the concentration of sodium chloride in the blood. Explain your answer.

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(3)

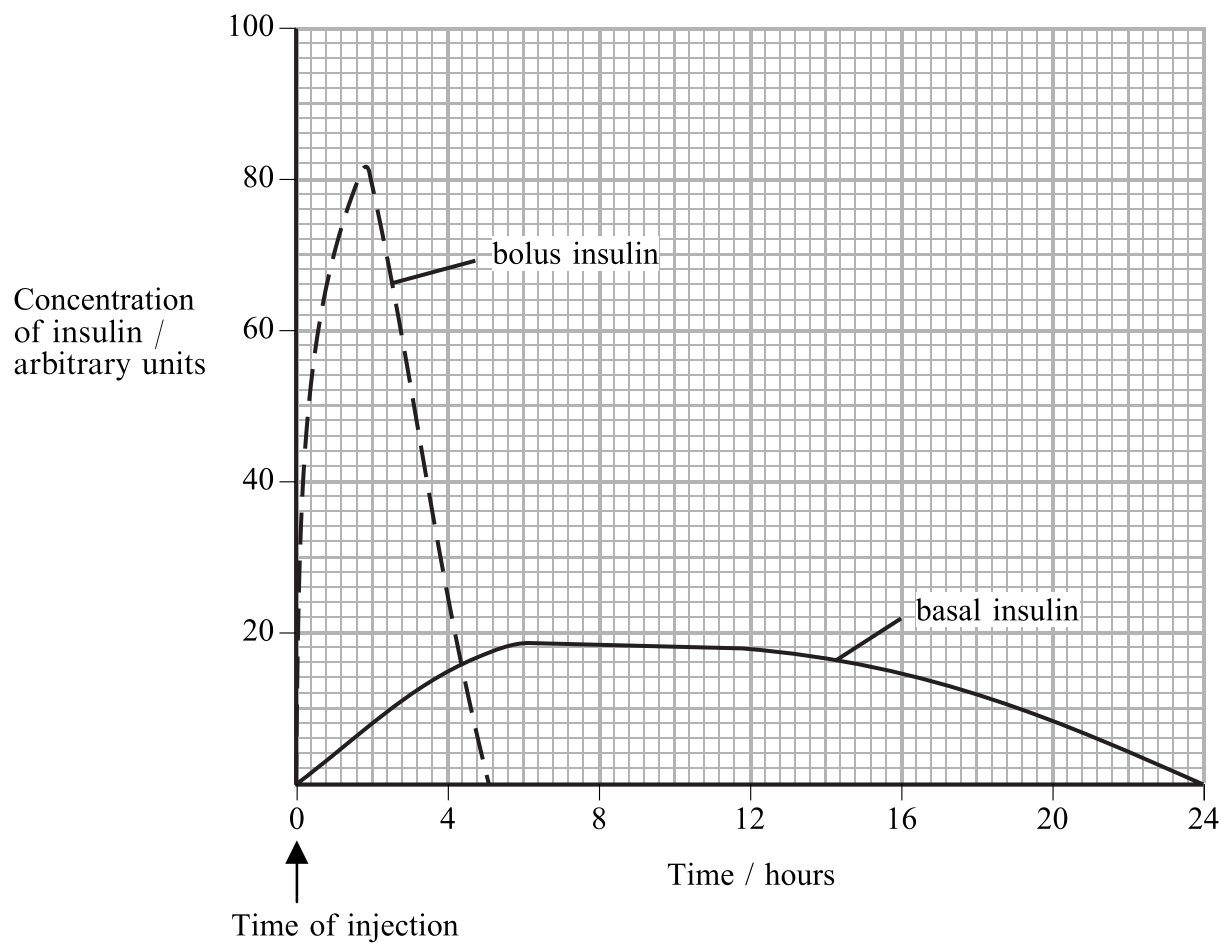
Q3

(Total 8 marks)



4. (a) Treatment of insulin-dependent diabetes is by injection of insulin. There are two types of insulin available, basal insulin and bolus insulin. Basal insulin is injected once a day and is absorbed slowly into the body. Bolus insulin is usually injected at each mealtime.

In an investigation, a diabetic person was injected with basal insulin and bolus insulin at the same time. The concentration of each type of insulin in the blood was measured during the 24 hours following the injection. The results are shown in the graph below.



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(i) Compare the changes in concentration of each type of insulin during the 24 hour period.

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(3)

(ii) Explain why a diabetic person might inject basal insulin as well as bolus insulin.

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(3)



(iii) Explain why diabetics should not inject bolus insulin more than 15 minutes before they eat.

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(2)

(b) Ray Swinner is an athlete who has insulin-dependent diabetes. Each unit of insulin that he injects lowers his blood glucose level by 1.5 mmol dm^{-3} . He has been advised to carry out carbohydrate counting. This involves estimating the number of grams of carbohydrate that is present in his meals. This enables him to calculate how much insulin to take to lower his blood glucose concentration.

Every 10 grams of carbohydrate is referred to as one carbohydrate portion (CP). He needs to inject 1.5 units of insulin for each CP that he eats. Ray eats the following meal for breakfast.

Food	Carbohydrate / g
Two fried eggs	0
Two slices of bacon	0
400 g of baked beans	65
Two slices of brown toast	40
150 cm ³ of fruit juice	15

Calculate the number of units of insulin that he should inject to control the rise in blood glucose level as a result of eating this meal. Show your working

Answer.....

(2)



(c) State **two** ways in which insulin reduces blood glucose concentration.

1

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(2)

(Total 12 marks)

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Q4

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N 2 4 7 3 4 A 0 1 3 2 4

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5. Give an account of anaerobic respiration of glucose in a mammalian muscle cell.

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Q5

(Total 10 marks)



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Option C: Human Health and Fitness.

6. Describe the roles of each of the following.

(a) Lymphocytes

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(2)

(b) Muscle spindles

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(2)

(c) Creatine phosphate (phosphocreatine)

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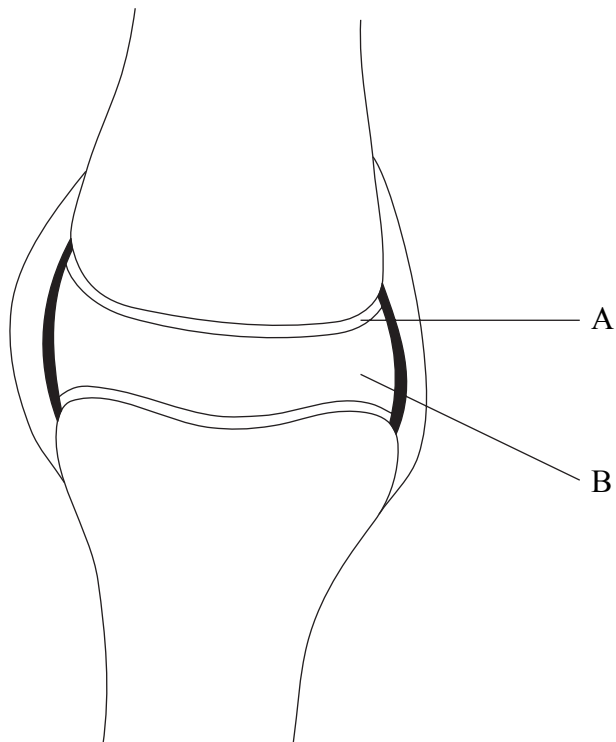
(2)

(Total 6 marks)

Q6



7. The diagram below shows the structure of a synovial joint.



(a) Name the parts labelled **A** and **B** on the diagram.

A

B

(2)

(b) Describe **two** characteristic features seen in an arthritic joint.

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(2)

(Total 4 marks)

Q7



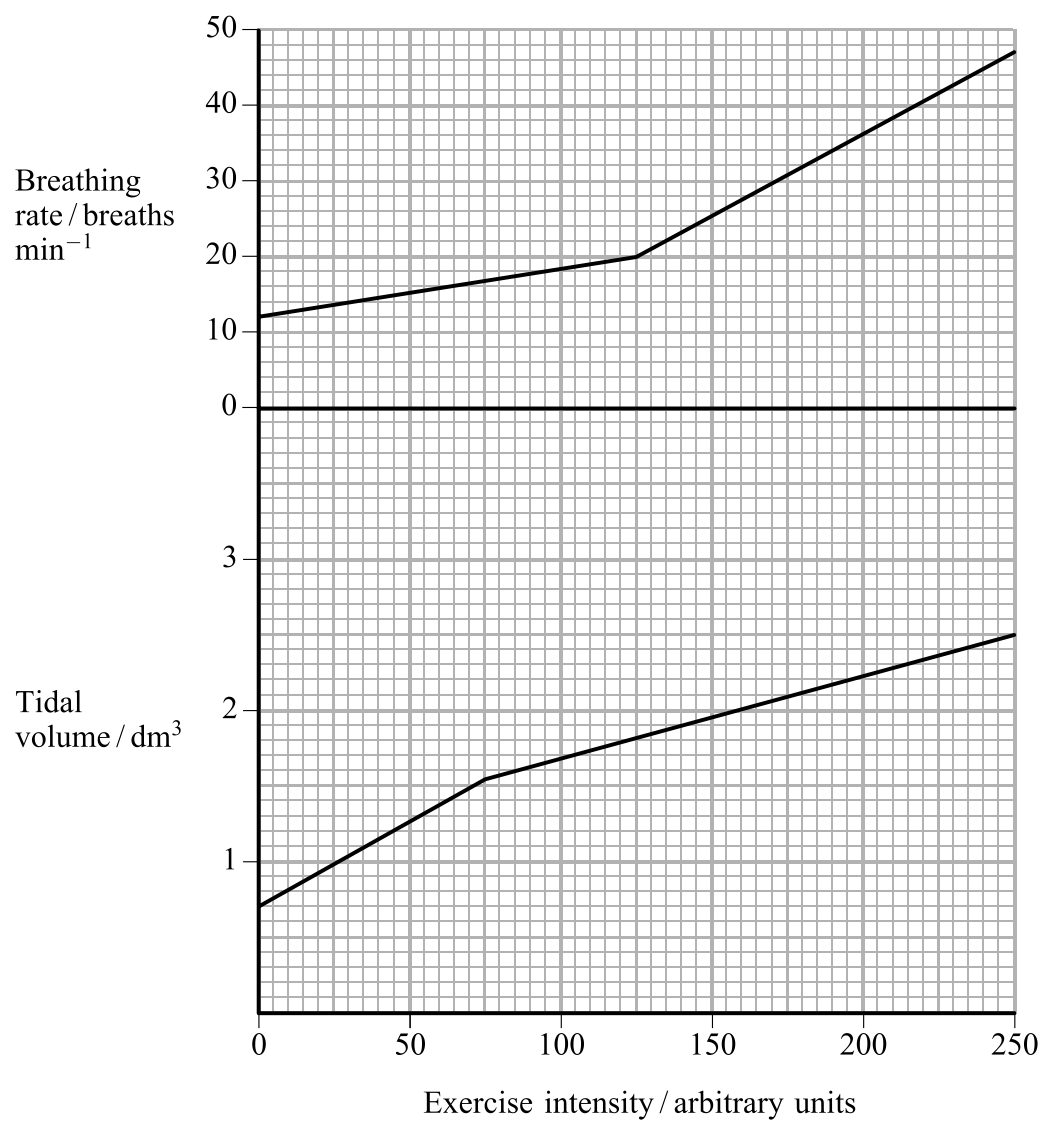
8. (a) Explain the meaning of the following terms.

Breathing rate

Tidal volume

(2)

(b) The graph below shows the changes that occur to the breathing rate and tidal volume as exercise intensity increases.



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(i) Describe the effect of increasing exercise intensity on the breathing rate and tidal volume.

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(3)

(ii) A training programme has an effect on the breathing rate and tidal volume.

Draw on the graph **two** curves, one to represent the breathing rate and the second to represent the tidal volume, of an individual who has followed a training programme.

Label the curve for breathing rate **B** and the curve for tidal volume **T**.

(3)

(c) Explain how the information given in the graph could be used to calculate the changes in **minute volume** as the exercise intensity increases.

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(3)

(Total 11 marks)

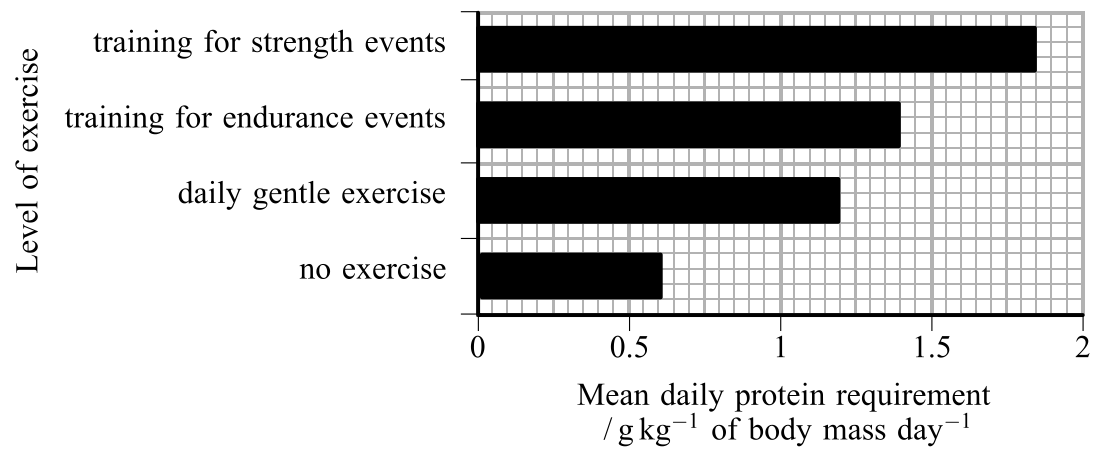
Q8

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9. Proteins form part of a healthy balanced diet for all individuals.

The graph below shows the mean daily protein requirement in grams per Kilogram of body mass per day, at various levels of exercise.

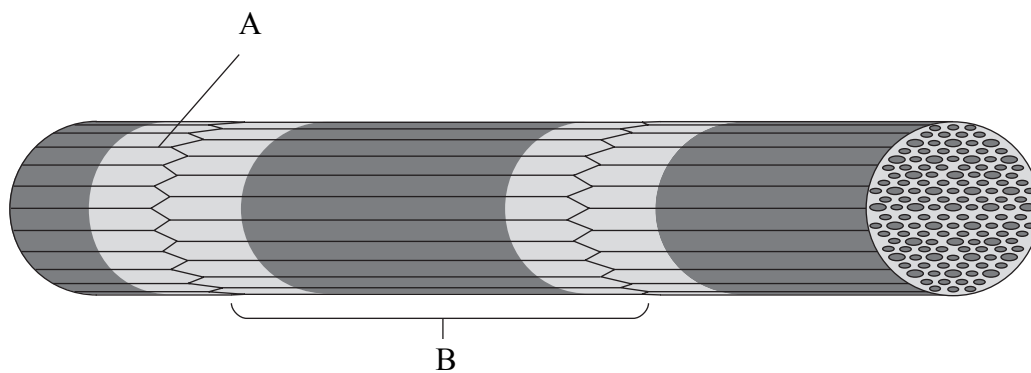


- (a) An adult who previously took no exercise, began to train for a marathon. Calculate the percentage increase in the mean daily protein requirement of this adult at the end of the marathon-training programme. Show your working.

Answer
(3)



(b) Training will increase muscle size by increasing the number of myofibrils in the fibres. The diagram below represents part of a single myofibril.



Name the two structures labelled **A** and **B**.

(i) A

(ii) B

(1)



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(c) Explain the role of each of the following in bringing about muscle contraction.

Myoglobin

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(3)

Calcium ions

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(2)

(Total 9 marks)

Q9

TOTAL FOR PAPER: 70 MARKS

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