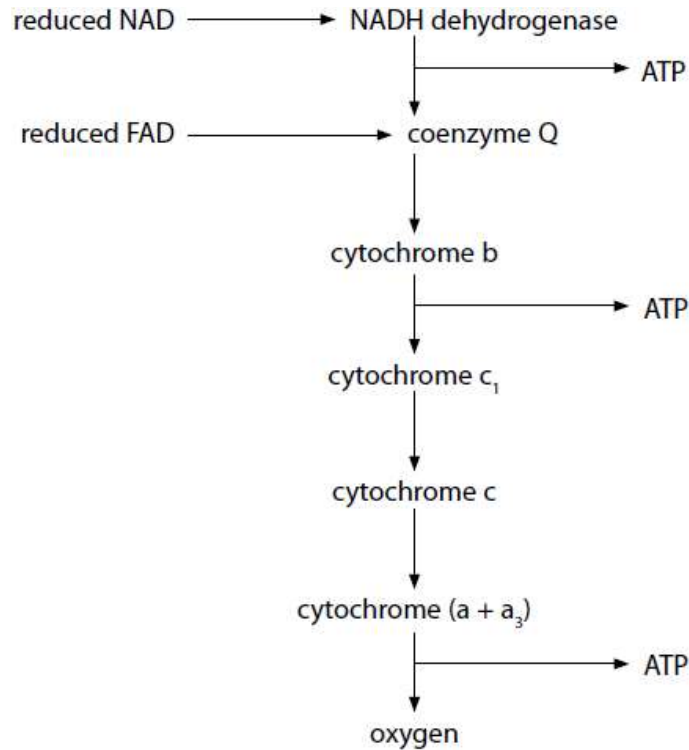


Respiration, Muscles and Internal Environment - Questions by Topic

Q1.

The diagram shows the sequence of electron carriers in the electron transport chain. The diagram also shows the stages where ATP is generated.



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

(1)

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

(b) The table gives some information about inhibitors of the electron transport chain.

Inhibitor	Site of inhibition
Cyanide	between cytochrome (a + a ₃) and oxygen
Rotenone	between NADH dehydrogenase and coenzyme Q

(i) Explain the effect that cyanide will have on ATP production by the electron transport chain.

(2)

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(ii) Metabolism of succinate results in the production of reduced FAD.

Explain the effect that rotenone will have on ATP production by the electron transport chain.

(2)

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(iii) Explain why these inhibitors will not affect the production of ATP from anaerobic respiration. Use the information in the table to support your answer.

(2)

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(Total for question = 7 marks)

Q2.

The kidney is involved in osmoregulation and the production of urine.

(a) (i) Which substances are filtered from the blood in the renal capsule?

(1)

- A** glucose and fibrinogen
- B** glucose, fibrinogen and urea
- C** glucose and urea
- D** urea and prothrombin

(ii) Which structure is acting as the filter in the renal capsule?

(1)

- A** basement membrane
- B** cells lining the renal capsule
- C** endothelial cells in the walls of the capillaries
- D** podocytes

(iii) Which transport mechanism is responsible for the uptake of glucose into the cells of the wall of the proximal tubule?

(1)

- A** diffusion
- B** endocytosis
- C** sodium co-transport
- D** osmosis

(iv) Explain why some urea is reabsorbed in the proximal tubule.

(2)

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(b) In an investigation, salt solution was injected into the carotid artery of a mammal.

The carotid artery carries blood to the head.

The rate of urine production was measured after the injection.

The table shows the results.

Time after injection of salt solution / min	Rate of urine production / $\text{cm}^3 \text{min}^{-1}$
0	7.0
5	1.1
10	0.6
15	1.0
20	1.5
25	2.2
30	2.4

(i) Calculate the percentage decrease in the rate of urine production 10 minutes after the injection.

Give your answer to 2 decimal places.

(2)

Answer %

(ii) At what times should more measurements be taken to find the lowest rate of urine production?

(1)

- A** at 1-minute intervals between 5 minutes and 10 minutes
- B** at 1-minute intervals between 5 minutes and 15 minutes
- C** at 1-minute intervals between 10 minutes and 15 minutes
- D** at 5 minutes, 10 minutes and 15 minutes, two more times

(iii) Explain the results of this investigation. Use the information in the table to support your answer.

(4)

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(Total for question = 12 marks)

Q3.

The scientific document you have studied is adapted from an article in nature.com:
Microgravity elicits reproducible alterations in cytoskeletal and metabolic gene and protein expression in space-flown Caenorhabditis elegans.

Use the information from the scientific document and your own knowledge to answer the following questions.

(a) Suggest why the authors of this article have named the species of nematode used in this study (paragraph 2).

(1)

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(b) State **one** ethical issue of using nematodes in this study.

(1)

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(c) Describe how microgravity can cause changes in gene expression in these nematodes (paragraph 4).

(3)

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(d) Suggest why there was a lower fat accumulation and shorter body length in nematodes grown in microgravity (paragraph 4).

(3)

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(e) Explain why there were reduced levels of a number of metabolic proteins in nematodes grown in microgravity (paragraph 6).

(4)

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(f) Explain why microarrays could be used to show that mitochondrial electron transport genes are downregulated, whereas the sirtuin gene was upregulated (paragraph 7).

(3)

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(g) Explain why Sudan Black was used in this study (paragraph 8).

(2)

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(h) Comment on the reliability of the data presented in Table 1 (paragraph 9).

(3)

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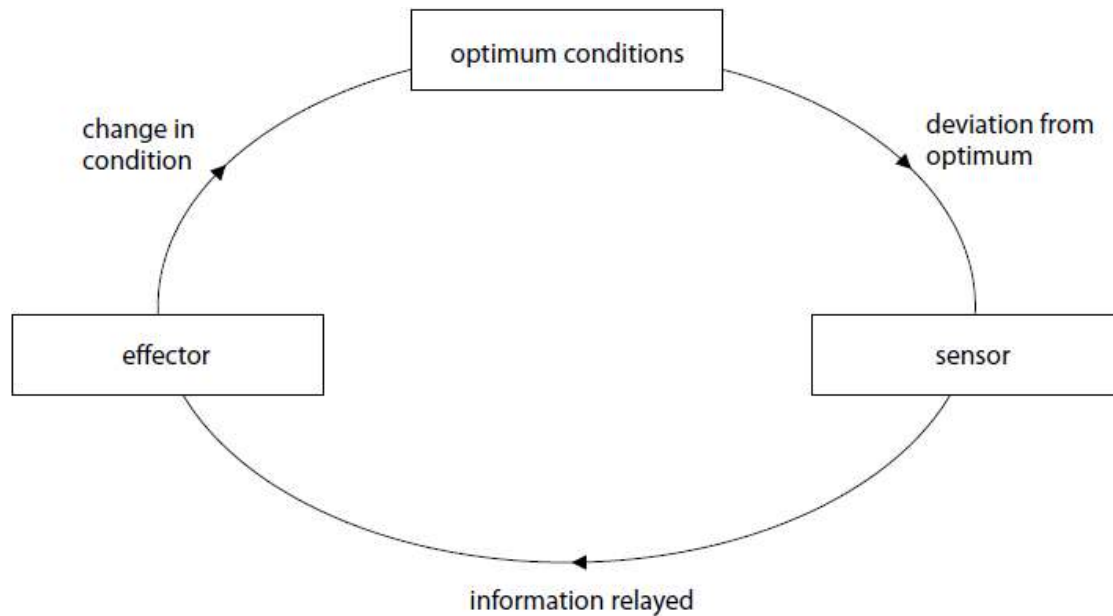
(Total for question = 20 marks)

Q4.

(a) Negative feedback is important in maintaining homeostasis.

Control of the ventilation rate is an example of negative feedback.

The diagram summarises negative feedback.



(i) Which row of the table shows the sensor and the location of the sensor involved in the control of ventilation?

(1)

	sensor	location of sensor
<input type="checkbox"/> A	baroreceptor	hypothalamus
<input type="checkbox"/> B	baroreceptor	medulla oblongata
<input type="checkbox"/> C	chemoreceptor	hypothalamus
<input type="checkbox"/> D	chemoreceptor	medulla oblongata

(ii) Explain why the control of ventilation rate is an example of negative feedback.

Use the information in the diagram to support your answer.

(4)

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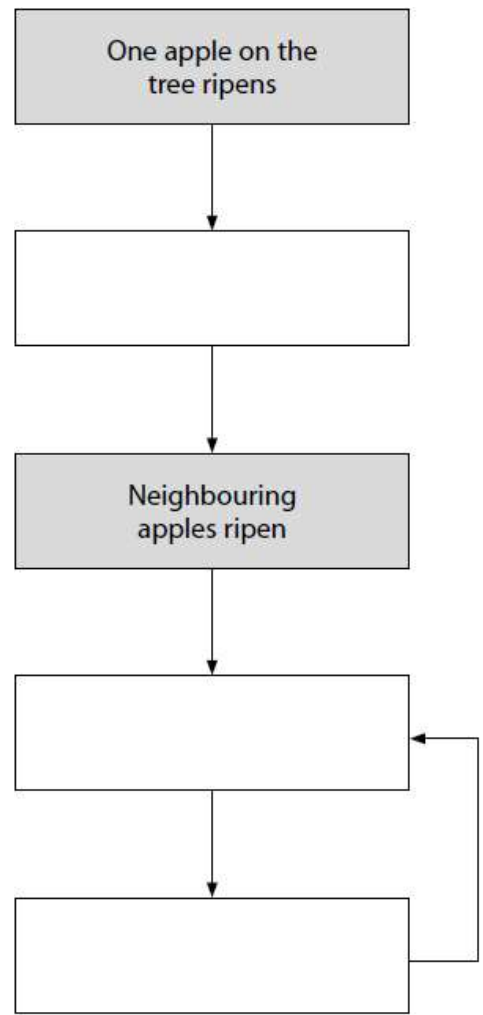
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(b) The ripening of apples is an example of positive feedback.
Ethene is a gas that causes apples to ripen. Ripe apples release ethene.
Complete the diagram to show positive feedback in the ripening of apples.

(3)



(Total for question = 8 marks)

Q5.

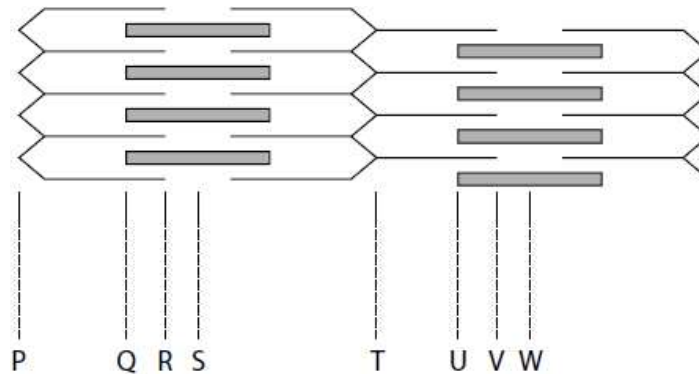
Movement in mammals results from the interaction between muscles, tendons, ligaments and the skeleton.

(a) Which row of the table describes tendons and ligaments?

(1)

	Tendons	Ligaments
<input type="checkbox"/> A	flexible, non-elastic tissue connecting bone to bone	flexible tissue connecting muscle to bone
<input type="checkbox"/> B	flexible, non-elastic tissue connecting muscle to bone	flexible tissue connecting bone to bone
<input type="checkbox"/> C	flexible tissue connecting bone to bone	flexible, non-elastic tissue connecting muscle to bone
<input type="checkbox"/> D	flexible tissue connecting muscle to bone	flexible, non-elastic tissue connecting bone to bone

(b) (i) The diagram shows part of a skeletal muscle fibre.



Which pair of letters represents one sarcomere?

(1)

- A P to T
- B Q to U
- C R to V
- D S to W

(ii) Compare and contrast the structure of fast-twitch and slow-twitch muscle fibres.

(4)

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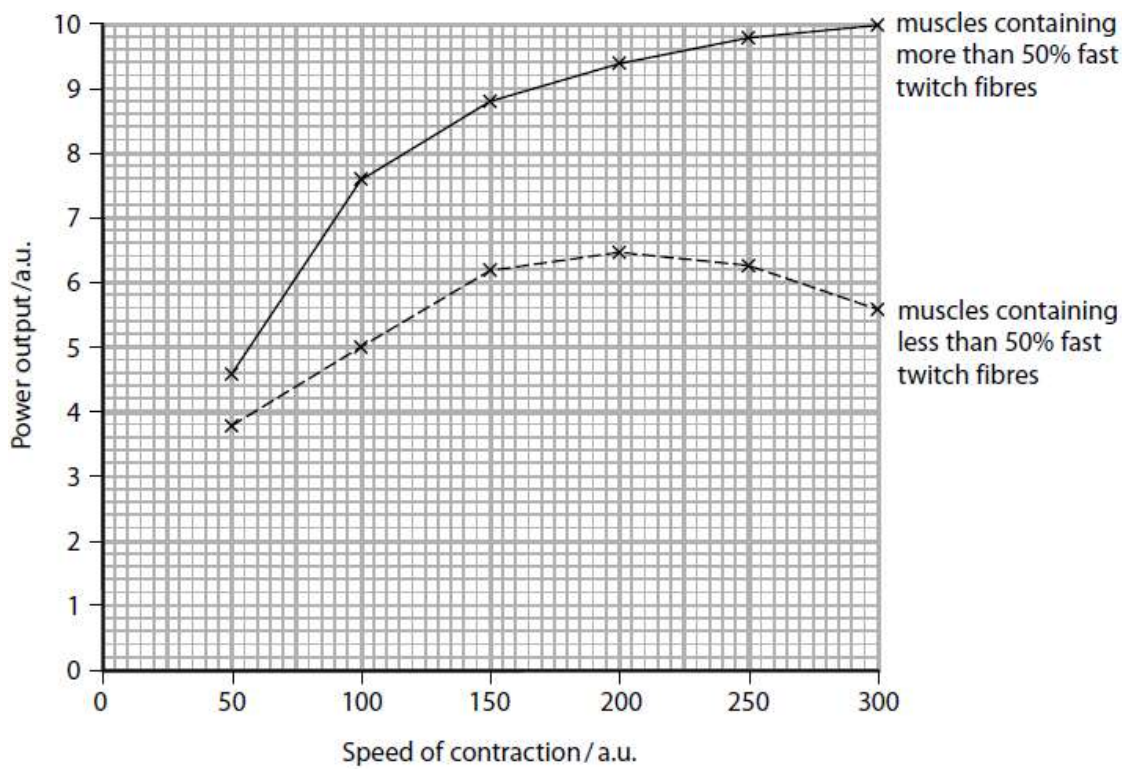
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*(c) The power output of a muscle depends on the speed of contraction and the proportion of fast-twitch and slow-twitch fibres in the muscle.

The graph shows the relationship between the power output and the speed of contraction of two different types of muscle.



Explain the relationship between power output and the speed of contraction of these two types of muscle. Use the information in the graph and your own knowledge to support your answer.

(6)

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(Total for question = 12 marks)