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**Answer ALL questions in the spaces provided.**

1. Rhodopsin is the light-sensitive pigment contained in rod cells.

The diagram below shows a rod cell from the retina of a mammal.



- (a) Use the letter **R** to label on the diagram where rhodopsin is found in the rod cell. **(1)**
- (b) When a person enters a dimly-lit room, after being in bright sunlight, objects in the room only gradually become more visible. Give an explanation for this.

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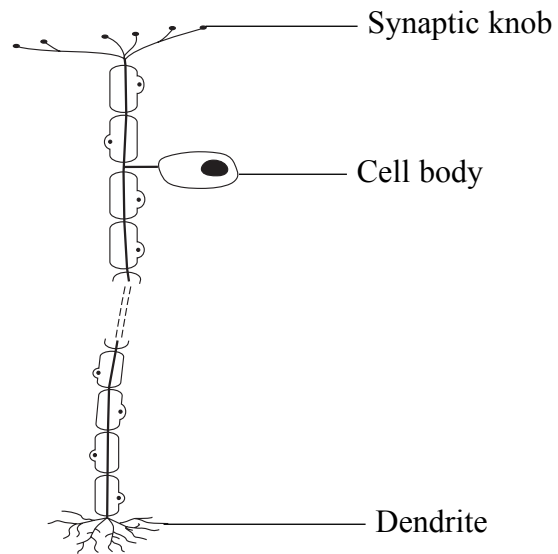
**(3)**

**Q1**

**(Total 4 marks)**



2. (a) The diagram below shows one type of mammalian neurone.



(i) Name the type of neurone shown in this diagram.

..... (1)

(ii) Describe the function of this type of neurone.

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(iii) Draw an arrow on the diagram to show the direction in which a nerve impulse would travel.

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(b) Explain what is meant by the term **action potential**.

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(Total 6 marks)

Q2



3. (a) The photograph below shows a mitochondrion as seen using an electron microscope.



PR. G Gimenez Martin/Science Photo Library  
Magnification  $\times 20\,000$

(i) Name the parts labelled **B** and **C**.

**B** .....

**C** .....

(2)

(ii) Give the **letter** that represents the location of the electron transport chain.

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(1)



(b) Antimycin A is an inhibitor of the electron transport chain. It binds to one of the electron carriers in the chain. An experiment was carried out to investigate the effect of Antimycin A on the respiration of yeast cells.

Yeast cells were mixed with a buffer solution containing ADP, phosphate ions and glucose to form a suspension. This suspension was then placed in a waterbath at 30 °C and incubated for 30 minutes. During this time, the oxygen content of the suspension was measured.

The experiment was then repeated with Antimycin A added to the suspension 5 minutes after the start of the incubation.

The results are shown in the table below.

Time of incubation / mins	Oxygen content of suspension / arbitrary units	
	Without Antimycin A	With Antimycin A added 5 minutes after the start of incubation
0	6.4	6.4
5	3.7	3.7
10	2.4	3.7
15	1.6	3.7
20	0.9	3.7
25	0.5	3.7
30	0.5	3.7

(i) Suggest why the oxygen content of the suspension of cells without Antimycin A did not reach zero.

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(2)



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(ii) Explain why the oxygen concentration of the suspension did not decrease after Antimycin A was added.

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(iii) Suggest what effect the addition of Antimycin A will have on the production of ATP.

Give an explanation for your answer.

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(3)

(Total 10 marks)

Q3



4. (a) An investigation was carried out to study the effect of the age of a person on the ability to control blood glucose concentration.

A group of non-diabetic men of different ages fasted (did not eat) for 12 hours and then their blood glucose concentration was measured. Each man then drank the same volume of a solution containing a high concentration of glucose.

The blood glucose concentration of each man was measured 30 minutes after drinking the solution. This allows time for all of the glucose to be absorbed into the bloodstream. The blood glucose concentration was measured again 120 minutes after drinking the solution.

The results are shown in the table below.

Age / years	Blood glucose concentration / mmol dm <sup>-3</sup>		
	After fasting, before drinking glucose solution	30 minutes after drinking glucose solution	120 minutes after drinking glucose solution
30	5.3	8.8	6.1
40	5.5	8.9	6.5
50	5.4	8.8	6.7
60	5.6	9.0	7.6
70	5.7	8.9	8.1
80	5.7	8.8	8.2

- (i) The blood glucose concentration at 120 minutes is lower than at 30 minutes after drinking the glucose solution.

Using information from the table, describe the effect of age on the rate at which blood glucose concentration falls.

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(3)



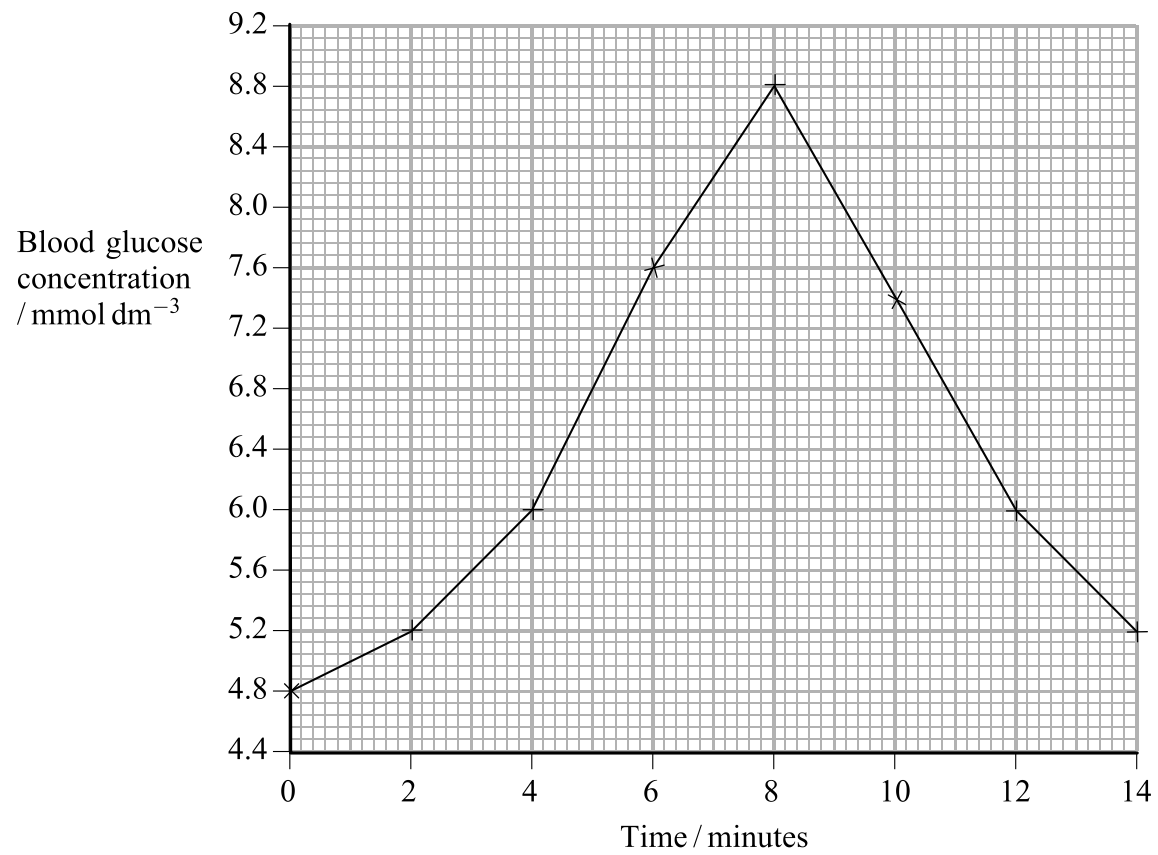
(ii) Suggest **one** explanation for the effect of age on the ability to control blood glucose concentration.

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(1)

(b) In a separate investigation, a man fasted for three hours and was then given an injection of glucagon. His blood glucose concentration was measured at two minute intervals after the injection.

The results are shown in the graph below.





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- (i) Calculate the percentage increase in blood glucose concentration between 0 and 8 minutes after the injection of glucagon. Show your working.

Answer .....%  
**(3)**

- (ii) Explain how glucagon causes an increase in blood glucose concentration.

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- (iii) Name **one** other hormone that causes an increase in blood glucose concentration.

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**(1)**

**(Total 11 marks)**

**Q4**

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**Option C: Human Health and Fitness**

6. The table below refers to some biologically important molecules, their location and function. Complete the table by writing in the most appropriate word or words in the empty boxes.

<b>Molecule</b>	<b>One location</b>	<b>One function</b>
Acetylcholine		
Creatine phosphate		
Hydroxyapatite		
Myoglobin		

**(Total 4 marks)**

**Q6**



7. The diet of an individual following a training programme is usually higher in carbohydrate than that of an individual not following a training programme.

(a) Explain why a high carbohydrate diet is necessary when following a training programme.

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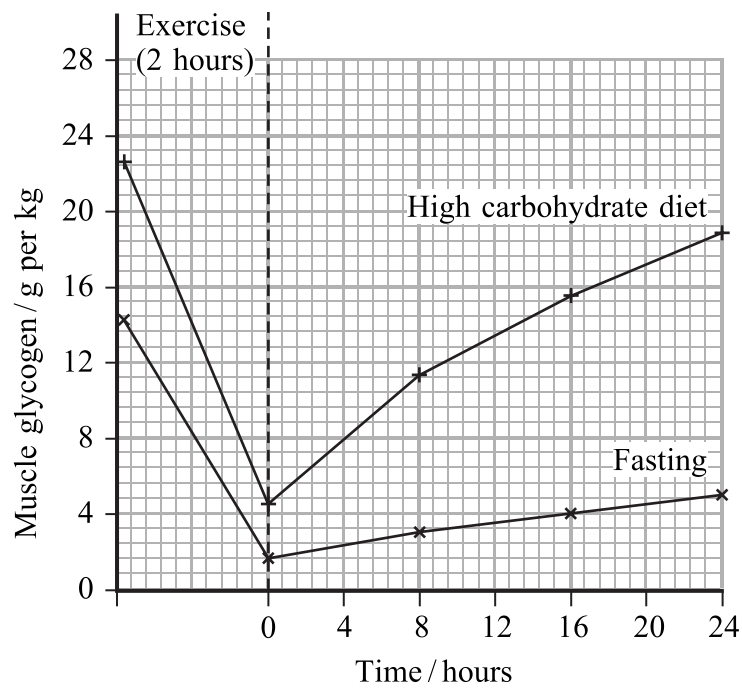
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(2)

(b) The graph below shows the changes in muscle glycogen in two individuals during and after two hours of exercise. One individual was on a high carbohydrate diet and the other individual was fasting (not consuming food).



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(i) Compare the changes in muscle glycogen during and after exercise in these two individuals.

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(2)

(ii) Suggest reasons for the differences you have described for the change in muscle glycogen after exercise.

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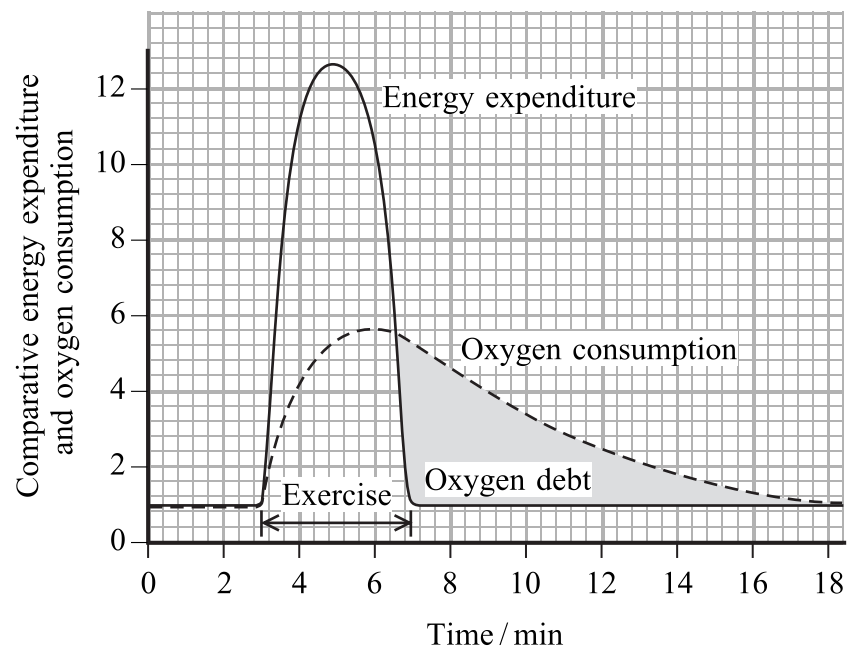
Q7

(Total 6 marks)



8. In an investigation, the energy expenditure and oxygen consumption of an individual were measured before, during and after four minutes of exercise.

The graph below shows the rate of energy expenditure and rate of oxygen consumption compared with those before exercise.



(a) (i) Describe the relationship between energy expenditure and oxygen consumption during the four minutes of exercise.

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(2)



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The oxygen debt is shown as the shaded area on the graph.

(ii) Explain why there is an oxygen debt after exercise.

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**(3)**

(b) Describe the role of ATP in muscle contraction during exercise.

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**(4)**

**Q8**

**(Total 9 marks)**







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(b) The table below shows the number of confirmed cases of coal miners' pneumoconiosis in the United Kingdom over a period of years from 1993 to 2005.

Year	Number of confirmed cases of coal miners' pneumoconiosis
1993	400
1994	560
1995	375
1996	325
1997	205
1998	485
1999	375
2000	335
2001	435
2002	1020
2003	1050
2004	1035
2005	670

(i) Calculate the greatest percentage difference between one year and the next.

Answer .....%  
**(2)**



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(ii) Describe the changes seen in the number of confirmed cases of coal miners' pneumoconiosis from 1993 to 2005.

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(3)

(c) There are very few reported cases of coal miners' pneumoconiosis in women. Suggest a reason for this.

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(1)

Q9

(Total 11 marks)

**TOTAL FOR PAPER: 70 MARKS**

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