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tutors**

Student number

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Name _____

Date _____

Attempt/Time taken _____

GCSE BIOLOGY

Topic Paper: 4.2 Respiration
Part 1

Time allowed: 45 minutes

Materials

For this paper you must have:

- the Periodic Table/Data Sheet, provided as an insert (enclosed)
- a ruler with millimetre measurements
- a calculator, which you are expected to use where appropriate.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The Periodic Table/Data Sheet is provided as in insert.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions you need to make sure that your answer:
 - is clear, logical, sensibly structured
 - fully meets the requirements of the question
 - shows that each separate point or step supports the overall answer.



40 Marks



Q1. In an investigation four groups of athletes were studied. The maximum rate of oxygen consumption for each athlete was measured and the mean for each group was calculated. The athletes then ran 10 mile races and the mean of the best times was calculated for each group. The results are shown in the table below.

GROUP OF ATHLETES	MAXIMUM RATE OF OXYGEN CONSUMPTION (cm ³ per kg per min)	BEST TIME IN 10 MILE RACE (minutes)
A	78.6	48.9
B	67.5	55.1
C	63.0	58.7
D	57.4	64.6

(i) What is the relationship between maximum rate of oxygen consumption and time for a 10 mile race?

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(1)

(ii) Suggest an explanation for this relationship.

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(3)

(Total 4 marks)

Q2. Marathon runners are recommended to have a high carbohydrate diet prior to a race. Three athletes tried out three dietary regimes prior to a marathon race.

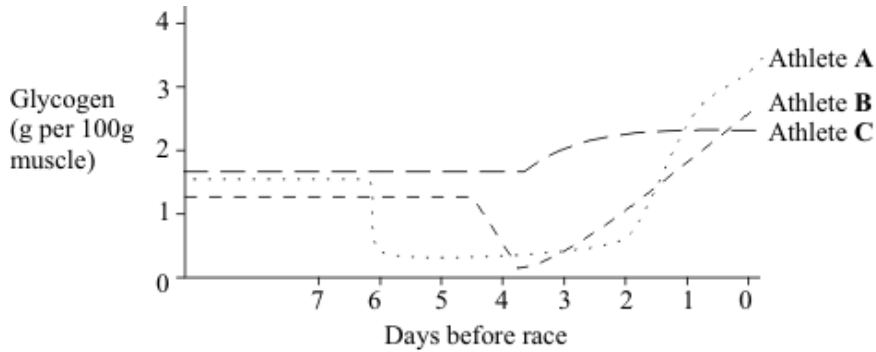
These three dietary regimes were as follows.

- Athlete A** Up to 7 days before the race - Normal mixed diet
- 7 days before the race - Prolonged extreme physical activity
- 6-3 days before the race - Protein and fat diet; no carbohydrate
- 2 and 1 days before the race - Large carbohydrate intake



- Athlete B** Up to 5 days before race - Normal mixed diet
 5 days before the race - Prolonged extreme physical activity
 4-1 days before the race - Large carbohydrate intake
- Athlete C** Up to 4 days before the race - Normal mixed diet
 4-1 days before the race - Large carbohydrate intake

The graph below shows the effect of each of these dietary regimes on glycogen levels in the athletes' muscles



- (a) (i) What is the immediate effect of extreme physical activity on the glycogen content of muscles?

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(1)

- (ii) Describe how this effect occurs.

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(3)



(b) (i) Evaluate the three regimes as preparation for a marathon race.

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(3)

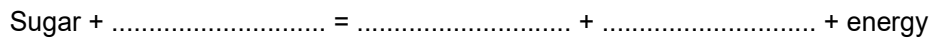
(ii) Suggest a possible explanation for the different effects of the three regimes.

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(2)

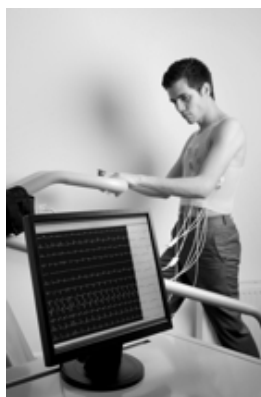
(Total 9 marks)

Q3. (a) During respiration, sugar is oxidised to release energy. Complete the equation for respiration.



(3)

(b) The photograph below shows an athlete using an exercise machine. The machine can be adjusted to vary the rate at which the athlete is required to work.



The athlete's heart rate and breathing rate were measured at different work rates.

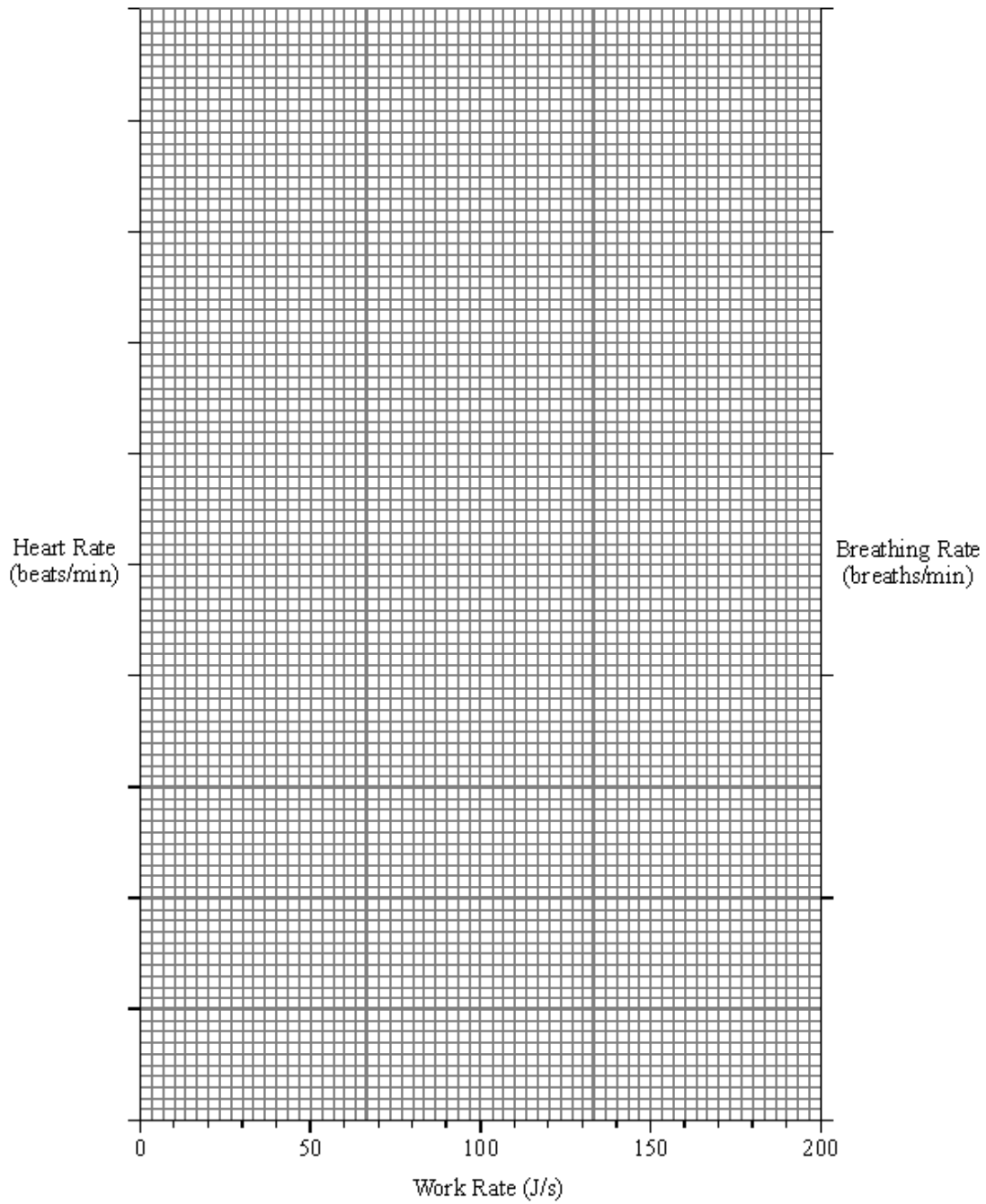


The table below shows the results which were obtained.

WORK RATE (J/s)	HEART RATE (beats/min.)	BREATHING RATE (breaths/min.)
0	86	9.6
60	106	10.0
80	112	10.4
100	122	10.4
120	135	11.4
140	143	14.5
160	156	15.8
200	174	30.5



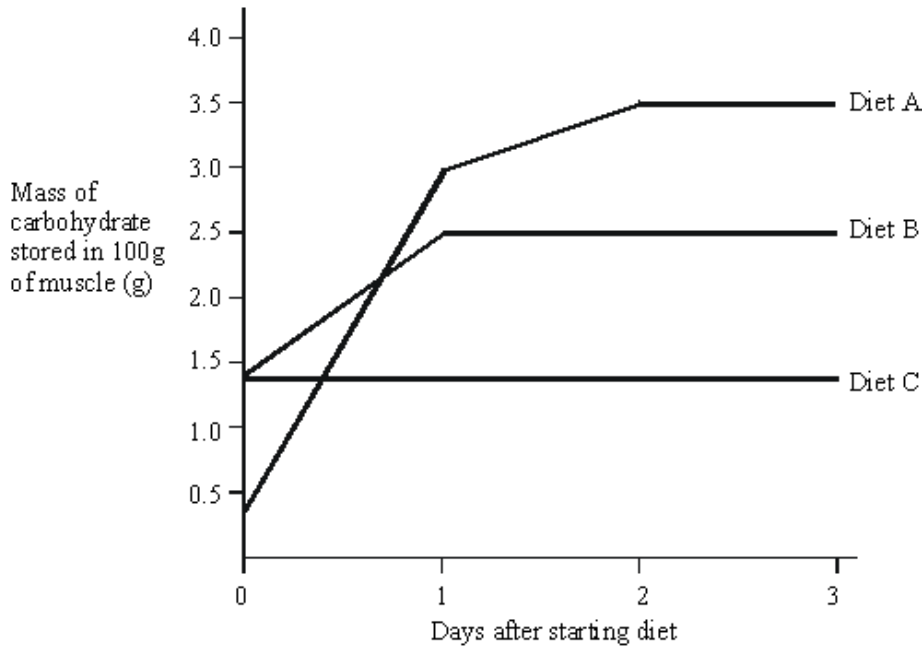
Plot the data on the graph paper below.



(3)



Q4. The graph below shows the effect of a high carbohydrate diet on the stored carbohydrate in the muscles.



- Diet A – High carbohydrate diet, started after several days of eating a diet without carbohydrate.
- Diet B – High carbohydrate diet, started after normal mixed diet.
- Diet C – Normal mixed diet.

What advice would you give the athlete about the best diet preparation for a long race? Explain why you would give this advice.

Diet

Explanation

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(Total 2 marks)



Q5. Regular exercise is important, as it helps to maintain an efficient supply of blood to the muscles, the heart and the lungs. This is helped by an increase in the heart rate during exercise.

Explain why it is necessary for the heart rate to increase during exercise.

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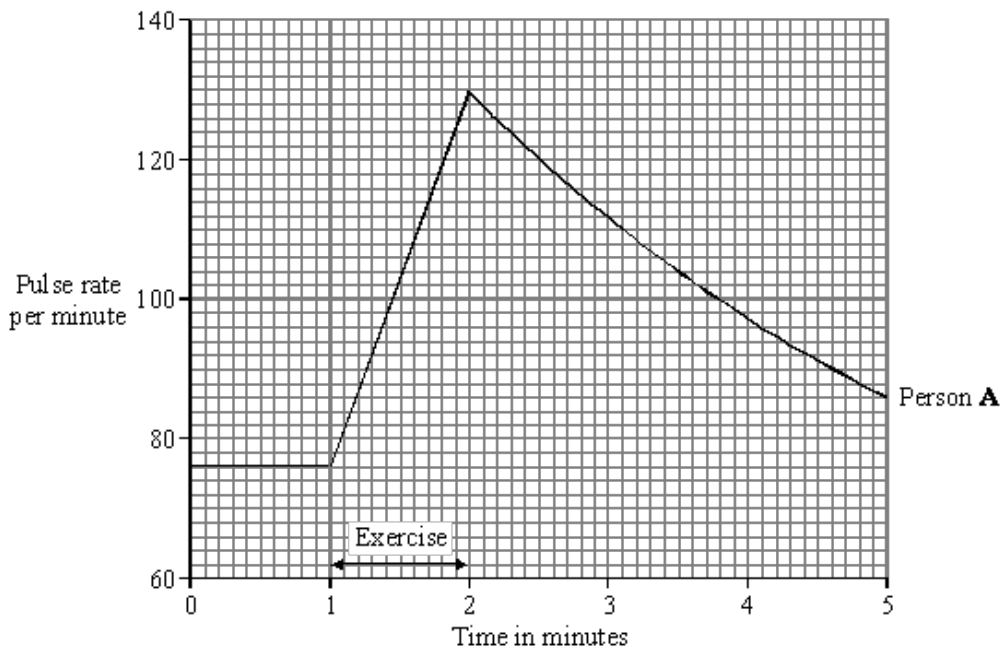
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(Total 4 marks)

Q6. **Person A** and **Person B** measured their pulse rates over a period of five minutes. For one minute of this time they exercised by stepping on and off a box. At other times they sat still. The graph shows the results for **Person A**.





- (i) What does the graph tell you about the changes in the pulse rate of **Person A** within the five minute period?

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(3)

- (ii) What was the pulse rate of **Person A** at the end of the five minute period?

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(1)

- (iii) The table shows the results obtained for **Person B**.

Time in minutes	Pulse rate per minute
0	68
1	68
2	110
3	96
4	80
5	68

Plot these results on the graph.

(2)
(Total 6 marks)