Q1. (a) (i) The table shows an athlete’s breathing rate after the end of a race.

The results can be put onto a graph. Three of the points are already plotted. Plot the other points shown in the table. Then draw the graph.

<table>
<thead>
<tr>
<th>Time after end of race (minutes)</th>
<th>Breathing rate (litres per second)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

(ii) What is the athlete’s breathing rate ½ (half) a minute after the end of the race?

..................................................................................................................
(b) One of the reasons for breathing is to get rid of carbon dioxide from your body. Choose words from the list to complete the sentences below about how your body does this.

- blood
- heart
- kidneys
- lungs
- urine

Carbon dioxide gets out of your body from your ..........................................................

The carbon dioxide is carried to this part of your body by your ..................................

(2)

(c) The bar charts show what happens in an athlete’s muscles when running in two races of different distances.

(i) Compare what happens in the athlete’s muscles when running in the two races.

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...........................................................................................................................
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(3)

(ii) Use the information in the box to explain your answer to (i).

- aerobic respiration: glucose + oxygen → carbon dioxide + water
- anaerobic respiration: glucose → lactic acid

...........................................................................................................................
...........................................................................................................................
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(2)

(Total 13 marks)
(a) The table shows the effect of exercise on the action of one person’s heart.

<table>
<thead>
<tr>
<th></th>
<th>At rest</th>
<th>During exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate in beats per minute</td>
<td>72</td>
<td>165</td>
</tr>
<tr>
<td>Volume of blood leaving the heart in each beat in cm(^3)</td>
<td>75</td>
<td>120</td>
</tr>
<tr>
<td>Heart output in cm(^3) per minute</td>
<td></td>
<td>5400</td>
</tr>
</tbody>
</table>

(i) Calculate the heart output for this person during exercise. Show clearly how you work out your answer.

Answer = .................. cm\(^3\) per minute

(ii) During exercise, more oxygen is carried to the working muscles. Explain why this is helpful during exercise.

Answer = .................. cm\(^3\) per minute

(b) Give two other changes in the body that help to increase the amount of oxygen delivered to the working muscles during exercise.

1. .................................................................
2. .................................................................

(Total 6 marks)
M1. (a) (i) points correctly plotted
   all correct gains 2 marks
   2 correct gains 1 mark

   each part of line correctly drawn (i.e. curve + straight line)
   for 1 mark each part of line

   (ii) 3 (or according to plotted graph)
litres per second
   for 1 mark each

(b) lungs
    blood
   for 1 mark each

(c) (i) ideas that
   • energy transferred faster in 100m race
   • carbon dioxide produced faster during 1500m race / more
   • carbon dioxide produced
   for 1 mark each

   correct reference to twice / half as fast in either / both cases
   for a further mark

   (ii)
   • respiration during 100m race (mainly) anaerobic
   • respiration during 1500m race (mainly) aerobic
   • aerobic respiration produced carbon dioxide
   • anaerobic respiration produced / lactic acid
   for 1 mark each
M2. (a) (i) 19 800

*for correct answer ignore working or lack of working*

*165 × 120 but no answer / wrong answer = 1 mark (ignore extras)*

(ii) any two from:

- for respiration
  *ignore oxygen debt*

- energy released
  *allow energy produced*

- prevents anaerobic respiration

- prevents build-up of lactic acid

(b) any two from:

- increased breathing rate(*)

- increased depth of breathing or deep breathing(*)
  
  (*)more breathing is max 1 mark
  
  *ignore increase in heart rate*
  
  *allow heavier breathing*
  
  *do not allow harder breathing*

- dilation of arteries / vasodilation
  
  *allow blood vessels dilate*
  
  *do not allow veins / capillaries dilate*

- blood diverted from elsewhere
  
  *ignore name of organ*