**Q1.**          (a)     (i)      Complete the word equation for the process of aerobic respiration.

Glucose       +     ...........................  →  carbon dioxide  +  water

**(1)**

(ii)     Which organ removes carbon dioxide from your body?

.................................................................................................................

**(1)**

(b)     Use names from the box to complete the **two** spaces in the passage.

|  |
| --- |
| carbon dioxide                lactic acid                 nitrogen                 oxygen                  water |

          Anaerobic respiration can occur when an athlete does vigorous exercise.

This is because there is not enough ....................................................... in the body.

          The product of anaerobic respiration is ................................................................. .

**(2)**

**(Total 4 marks)**

**Q2.**Respiration can happen aerobically or anaerobically.

Respiration transfers energy from glucose.

(a)     Draw **one** line from each type of respiration in human cells to the correct information.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Type of respiration in human cells** |  | **Information** |
|  |  |  |  |
|  |  |  | Produces ethanol |
|  |  |  |  |
|  | Aerobic respiration |  | Uses oxygen |
|  |  |  |  |
|  | Anaerobic respiration |  | Uses carbon dioxide |
|  |  |  |  |
|  |  |  | Produces lactic acid |

**(2)**

(b)     The table below shows the amount of energy released by aerobic and anaerobic respiration.

|  |  |  |
| --- | --- | --- |
|  |  | **Energy in kJ transferred from 1 g of glucose** |
|  | Aerobic respiration | 16.1 |
|  | Anaerobic respiration | 1.2 |

Suggest why human cells might respire anaerobically, even though only a small amount of energy is transferred.

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**(1)**

(c)     Yeast is used in the brewing and baking industries.

Why is yeast used in these industries?

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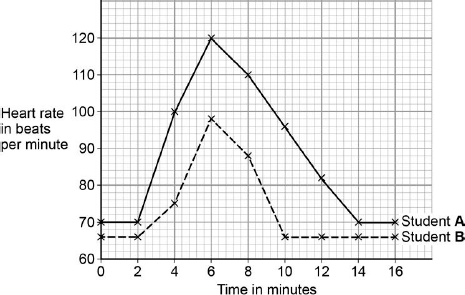
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**(4)**

**(Total 7 marks)**

**Q3.**Some students investigated how exercise affects heart rate.

The figure below shows their results.



(a)     What was Student **B**’s resting heart rate?

  Resting heart rate = ............................. beats per minute

**(1)**

(b)     The students started running at 2 minutes.

What evidence for this is in the figure above?

........................................................................................................................

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**(1)**

(c)     For how many minutes did the students run?

Tick **one** box.

|  |  |  |
| --- | --- | --- |
|  | 2 |  |
|  | 4 |  |
|  | 6 |  |
|  | 14 |  |

**(1)**

(d)     Student **B** is fitter than Student **A**.

Use the figure above to give **two** pieces of evidence that support this statement.

1 .....................................................................................................................

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2 .....................................................................................................................

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**(2)**

(e)     There are other changes in the body during exercise.

Explain why these changes occur.

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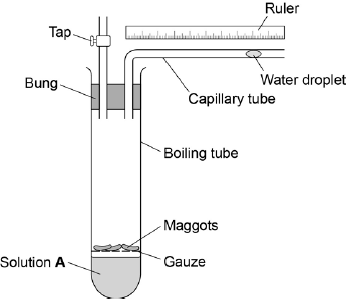
**(4)**

**(Total 9 marks)**

**Q4.**A student investigates the rate of respiration in maggots.

**Figure 1** shows the equipment he uses.

**Figure 1**

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(a)     Why does the student put the maggots on gauze?

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**(1)**

(b)     When maggots respire they take in a gas from the air and release a different gas.

Solution **A** absorbs the gas released.

At the start of the investigation the student records the distance of the water droplet from the bend in the capillary tube.

Explain what happens to the water droplet as the maggots respire.

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**(4)**

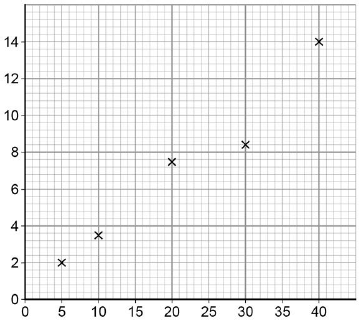
(c)     The table below shows the results the student calculated.

|  |  |  |
| --- | --- | --- |
|  | **Temperature in °C** | **Rate of respiration in units** |
|  | 5 | 2.2 |
|  | 10 | 3.5 |
|  | 20 | 7.5 |
|  | 30 | 8.4 |
|  | 40 | 14.0 |

The student uses his results to plot the graph in **Figure 2**.

Label the *x* and *y* axis.

**Figure 2**

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**(1)**

(d)     How could the student find out if the result at 30 °C is anomalous?

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

(e)     Suggest what the value at 30 °C should be to fit the pattern of the graph.

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

**(Total 8 marks)**

**Q5.**          The table shows the amounts of energy used in running and in walking at different speeds by people of different body masses.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Activity** | **Energy used in kilojoules per hour** | | | |
| **34 kg person** | **50 kg person** | **70 kg person** | **90 kg person** |
| Running, 9 km per hour | 1530 | 1850 | 2770 | 3700 |
| Running, 11 km per hour | 2140 | 2560 | 3860 | 5120 |
| Running, 16 km per hour | 2980 | 3570 | 5380 | 7140 |
| Walking, 3 km per hour | 530 | 670 | 1010 | 1340 |
| Walking, 5 km per hour | 740 | 880 | 1340 | 1760 |
| Walking, 7 km per hour | 1030 | 1240 | 1850 | 2480 |

(a)     Describe **two** patterns you can see in the data.

1 .................................................................................................................................

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2 .................................................................................................................................

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**(2)**

(b)     Our breathing rate is much higher when running than when walking.

Explain the advantage of this to the body.

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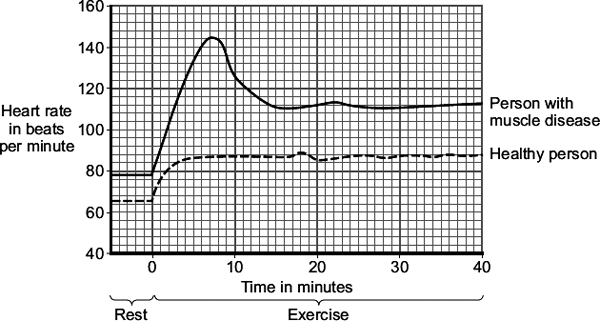
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**(3)**

**(Total 5 marks)**

**Q6.**         Two people did the same amount of gentle exercise on an exercise cycle.  
One person had a muscle disease and the other had healthy muscles.

The graph shows the effect of the exercise on the heart rates of these two people.



(a)     Describe **three** ways in which the results for the person with the muscle disease are different from the results for the healthy person.

To gain full marks in this question you need to include data from the graph in your answer.

1 .....................................................................................................................

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2 .....................................................................................................................

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3 .....................................................................................................................

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**(3)**

(b)     The blood transports glucose to the muscles at a faster rate during exercise than when a person is at rest.

(i)      Name **one** other substance that the blood transports to the muscles at a faster rate during exercise.

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**(1)**

(ii)     People with the muscle disease are not able to store glycogen in their muscles.

The results shown in the graph for the person with the muscle disease are different from the results for the healthy person.

Suggest an explanation for the difference in the results.

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**(3)**

**(Total 7 marks)**

**Q7.Figure 1** shows an athlete running on a treadmill.

**Figure 1**

****

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After running for several minutes, the athlete’s leg muscles began to ache.   
This ache was caused by a high concentration of lactic acid in the muscles.

(a)     The equation shows how lactic acid is made.

glucose  lactic acid (+ energy)

Name the process that makes lactic acid in the athlete’s muscles.

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**(1)**

(b)     Scientists investigated the production of lactic acid by an athlete running at different speeds.

In the investigation:

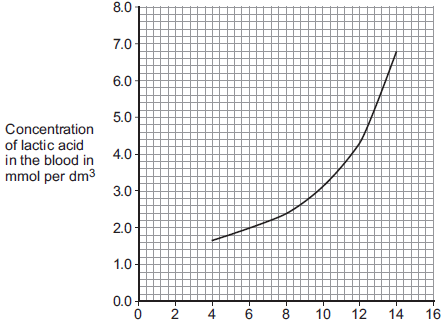
•        the athlete ran on the treadmill at 4 km per hour

•        the scientists measured the concentration of lactic acid in the athlete’s blood after 2 minutes of running.

The investigation was repeated for different running speeds.

**Figure 2** shows the scientists’ results.

**Figure 2**

****   
                             Treadmill speed in km per hour

(i)      How much more lactic acid was there in the athlete’s blood when he ran at 14 km per hour than when he ran at 8 km per hour?

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Answer = ......................... mmol per dm3

**(2)**

(ii)     Why is more lactic acid made in the muscles when running at 14 km per hour than when running at 8 km per hour?

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**(3)**

**(Total 6 marks)**

**Q8.**          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 dietry 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

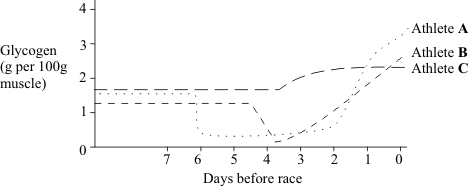
                   5 days before the race                 -           Prolonged extreme physical activity

                   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)**

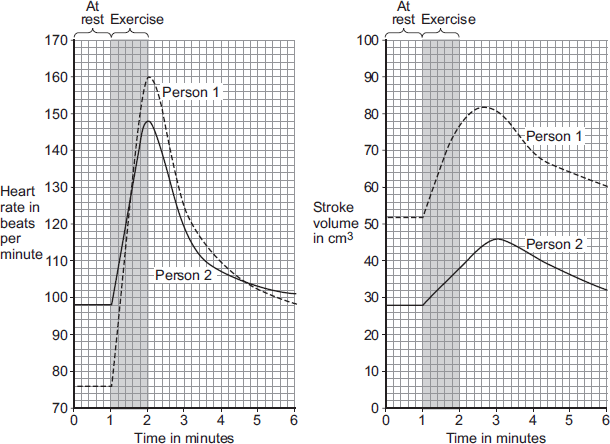
**(Total 9 marks)**

**Q9.**During exercise, the heart beats faster and with greater force.

The ‘heart rate’ is the number of times the heart beats each minute.The volume of blood that travels out of the heart each time the heart beats is called the ‘stroke volume’.

In an investigation, **Person 1** and **Person 2** ran as fast as they could for 1 minute. Scientists measured the heart rates and stroke volumes of **Person 1** and **Person 2** at rest, during the exercise and after the exercise.

The graph below shows the scientists’ results.



(a)     The ‘cardiac output’ is the volume of blood sent from the heart to the muscles each minute.

              Cardiac output = Heart rate × Stroke volume

At the end of the exercise, **Person 1**’s cardiac output = 160 × 77 = 12 320 cm3 per minute.

Use information from **Figure above** to complete the following calculation of **Person 2**’s cardiac output at the end of the exercise.

At the end of the exercise:

**Person 2**’s heart rate        = .............................. beats per minute

**Person 2**’s stroke volume = .............................. cm3

**Person 2**’s cardiac output = .............................. cm3 per minute

**(3)**

(b)     **Person 2** had a much lower cardiac output than **Person 1.**

(i)      Use information from **Figure above** to suggest the **main** reason for the lower cardiac output of **Person 2**.

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**(1)**

(ii)     **Person 1** was able to run much faster than **Person 2**.

Use information from **Figure above** and your own knowledge to explain why.

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**(5)**

**(Total 9 marks)**