AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



EXAM QUESTION PACK

4.4.2 RESPIRATION (PACK 3)

SCORE	PERCENTAGE
/198	%

STEMUP

These questions belong to AQA, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by AQA. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with AQA and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. AQA has not endorsed, approved or been involved in the production of it. AQA and the qualification titles used here belong to their respective owners and appear for identification only.

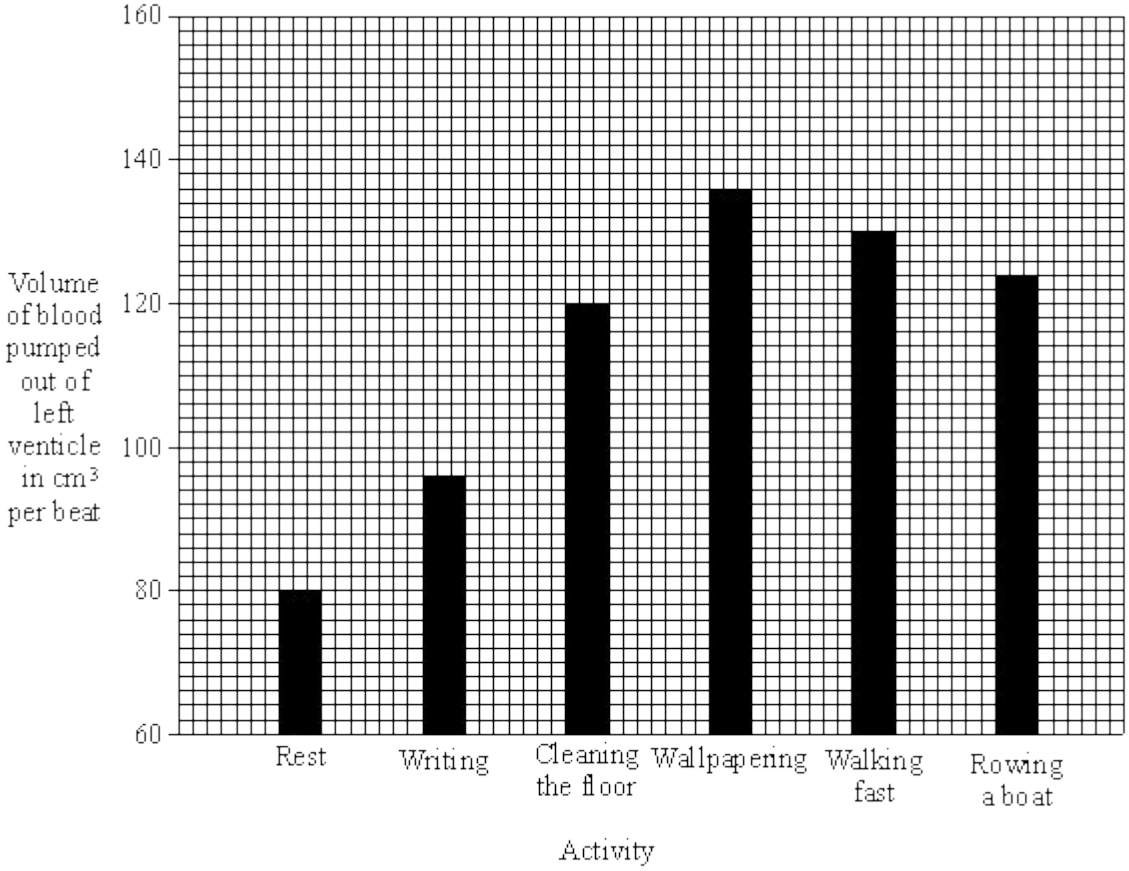
Where to find the originals

AQA publishes its past papers, mark schemes and examiner reports. Always check the current specification at aqa.org.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Q1.

(a) The volume of blood pumped out of the left ventricle at each beat was measured for a person during six different activities. These activities showed an increasing energy demand, with rest requiring the least energy and rowing a boat the most. The results of these measurements are shown on the bar chart.

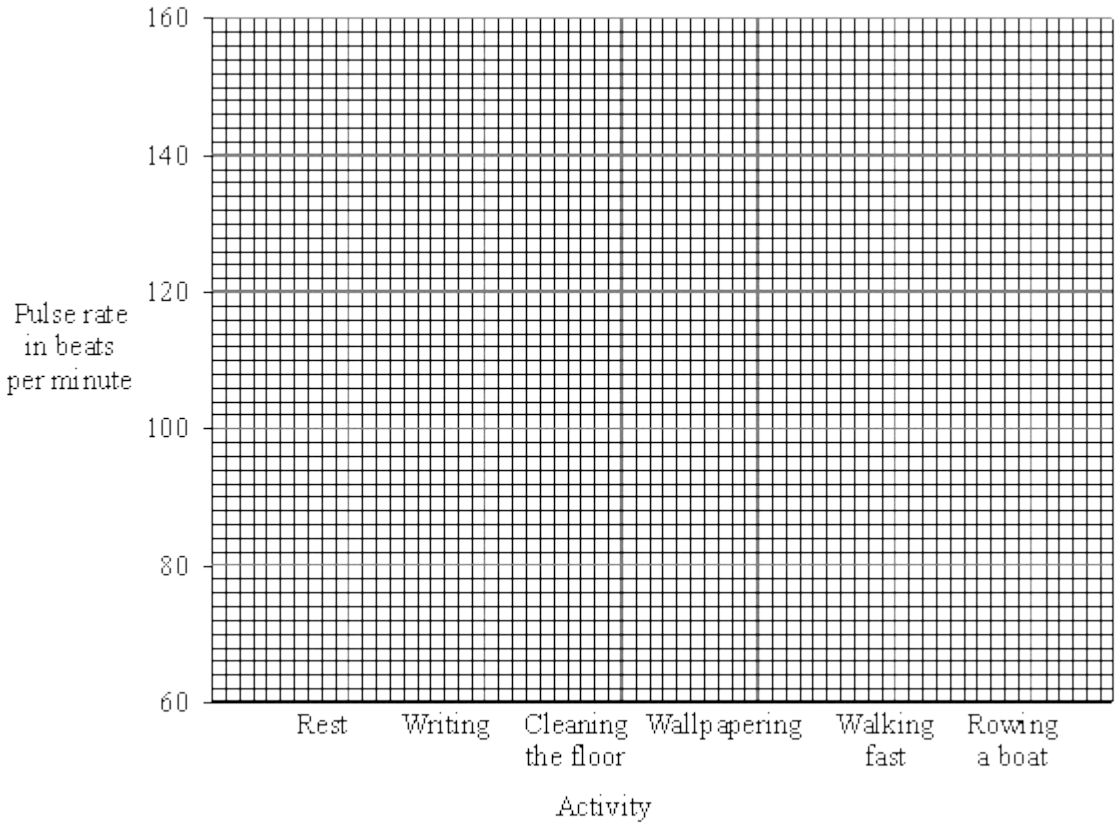


(i) The pulse rate was also measured for the person during the same activities. The table shows the results that were obtained.

Activity	Pulse rate in beats per minute
Rest	70
Writing	85
Cleaning the floor	100
Wallpapering	120
Walking fast	132
Rowing a boat	153

On the graph paper below draw a bar chart of the results obtained for the measurements of the pulse rate.

STEMUP.CO.UK



(2)

(ii) Undertaking activities with increasing energy demand has an effect on the volume of blood pumped from the left ventricle (per beat) and on the pulse rate. What do the bar charts show these effects to be? Use only information shown in the bar charts in your answer.

_____

_____

_____

(2)

(b) The pulse rate changed when the activity changed. Explain the reason for this.

_____

_____

_____

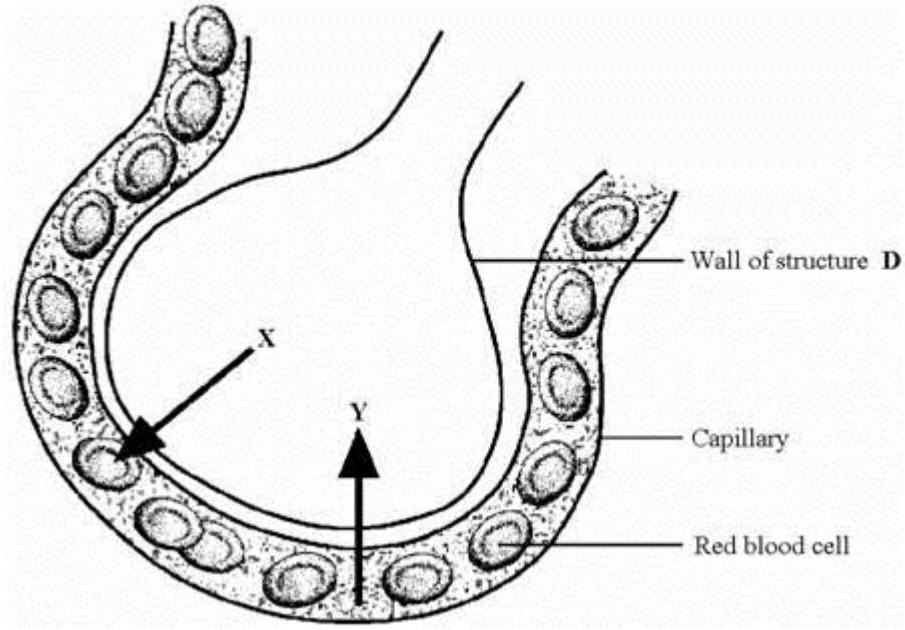
(2)

(Total 6 marks)

Q2.

The diagram shows an enlargement of structure **D**.

STEMUP.CO.UK



The arrows show the direction of the gases exchanged in this structure. Name gas **X** and gas **Y**.

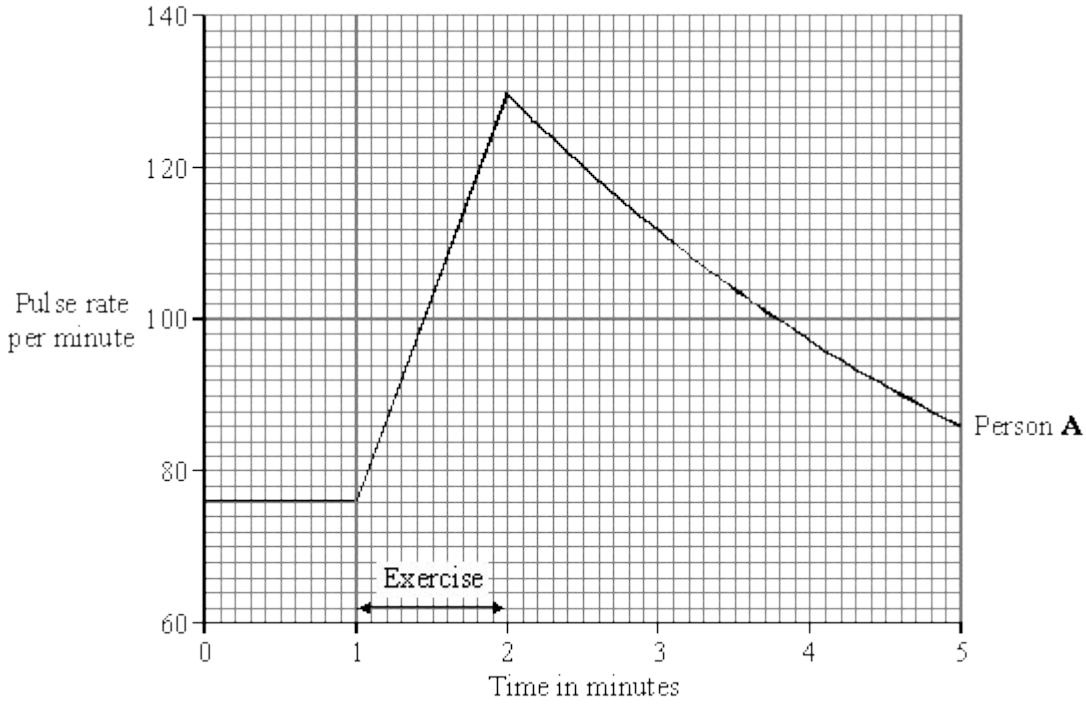
X _____

Y _____

(Total 2 marks)

Q3.

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**.



STEMUP.CO.UK

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

_____

_____

_____

_____

_____

(3)

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

_____

(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)

Q4.

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

Sugar + _____ = _____ + _____ + energy

(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.

STEMUP.CO.UK

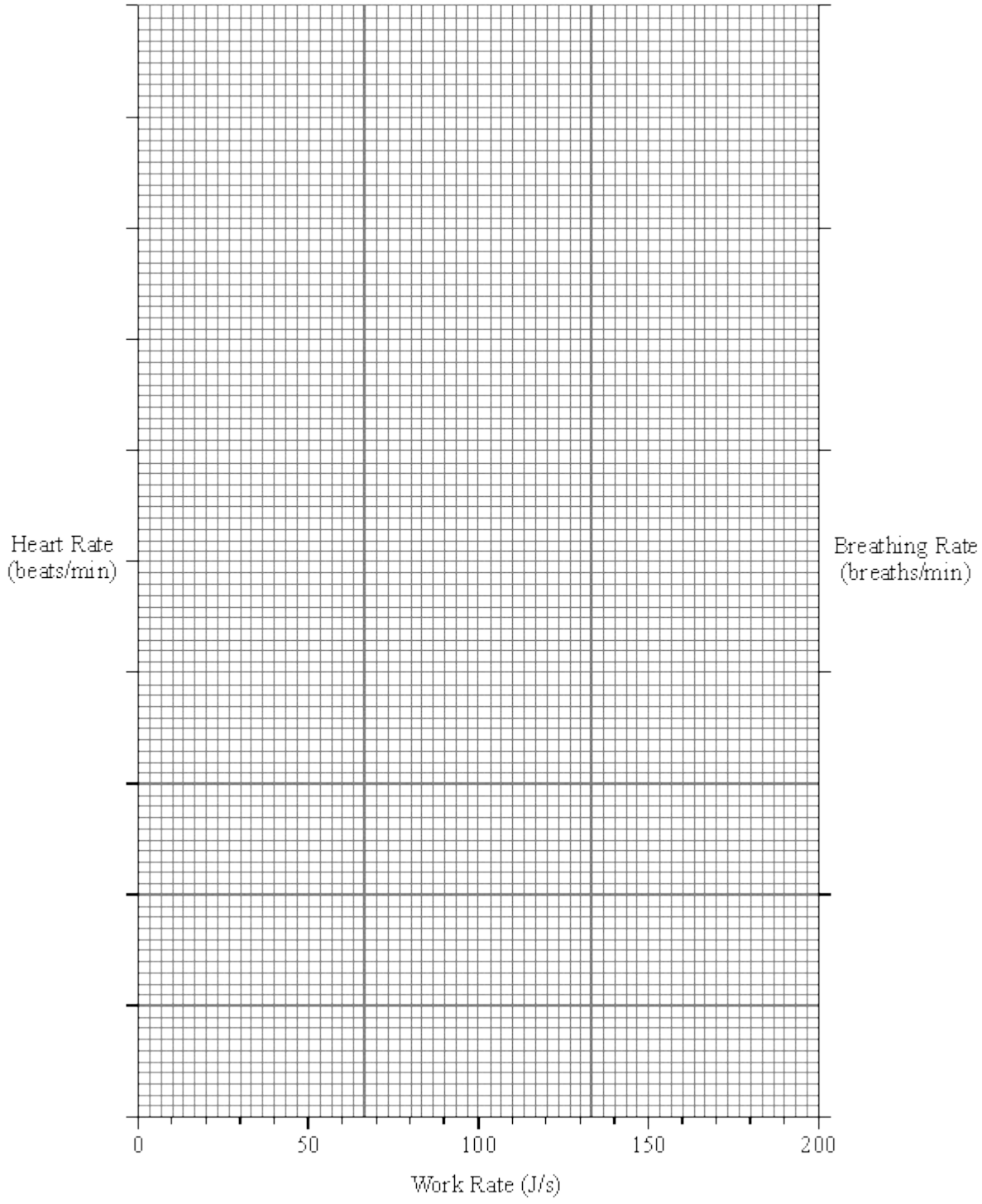


The athlete's heart rate and breathing rate were measured at different work rates.

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)

(c) Explain, as fully as you can, the advantages to the body in the change in breathing and heart rates.

_____

_____

_____

_____

_____

STEMUP.CO.UK

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

(d) This increase in the rate of heart-beat is a response to a stimulus. For this response suggest:

(i) the stimulus; _____

(ii) the co-ordinator; _____

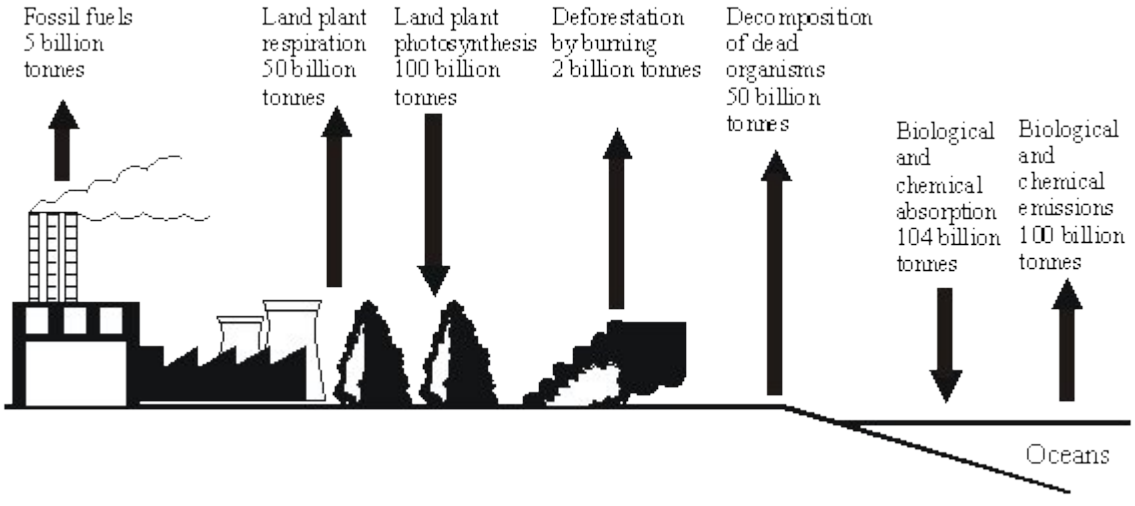
(iii) the effector. _____

(3)

(Total 15 marks)

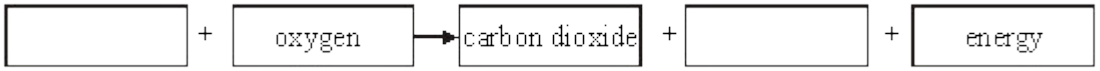
Q5.

The diagram below shows the mass of carbon involved each year in some of the processes in the carbon cycle.



STEMUP.CO.UK

(a) Complete the equation for plant respiration.



(2)

(b) (i) Calculate the mass of carbon removed from the atmosphere each year. *(Show your working.)*

Answer _____ billion tonnes

(1)

(ii) Calculate the percentage of this total which is removed by the photosynthesis of land plants. (*Show your working*.)

Answer _____ %

(2)

(iii) Calculate the net gain of carbon by the atmosphere in one year. *(Show your working.)*

Answer _____ billion tonnes

(2)

(Total 7 marks)

Q6.

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.

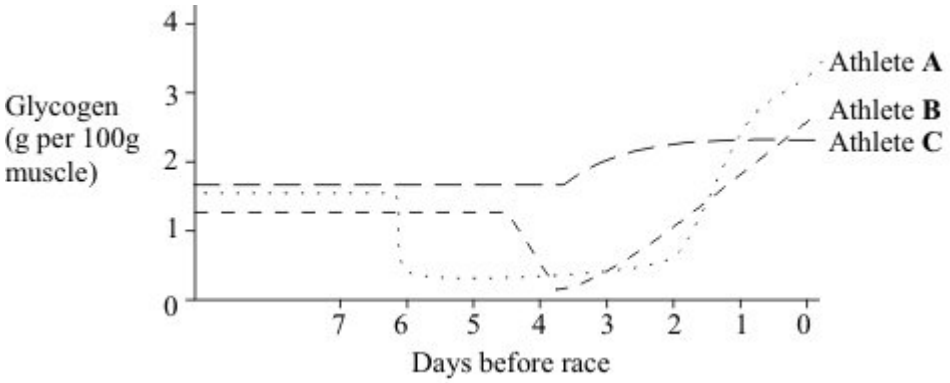
Athlete A	Up to 7 days before the race	-	Normal mixed diet
	7 days before the race	-	Prolonged extreme physical activity
	6-3 days before the race	-	Protein and fat diet; no carbohydrate
	2 and 1 days before the race	-	Large carbohydrate intake
Athlete B	Up to 5 days before race	-	Normal mixed diet
	5 days before the race	-	Prolonged extreme physical activity
	4-1 days before the race	-	Large carbohydrate intake

STEMUP.CO.UK

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?

_____

_____

(1)

(ii) Describe how this effect occurs.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

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

_____

_____

_____

_____

_____

STEMUP.CO.UK

_____

(3)

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

_____

_____

_____

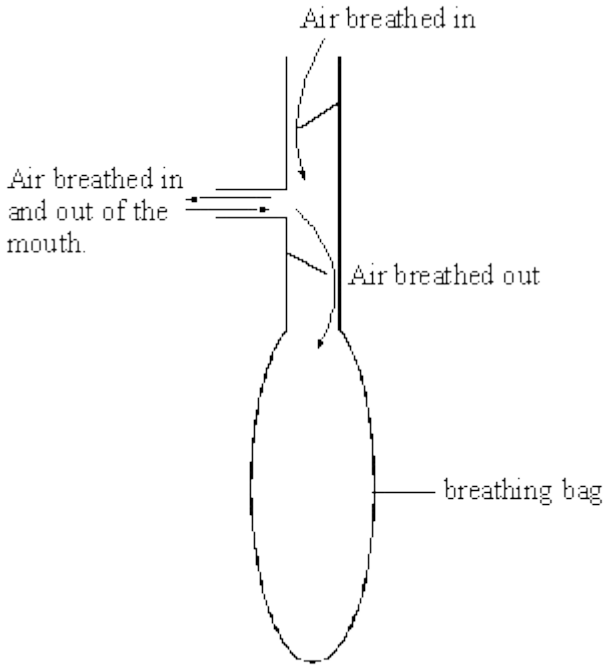
_____

(2)

(Total 9 marks)

Q7.

A student breathed out into an empty breathing bag five times.



After breathing out five times the volume of air in the bag was measured. The volume was 3000 cm^3.

(a) Complete the following sentences.

The air the student breathed in would contain more _____ than the air the student breathed out.

The air the student breathed out would contain more _____ than the air the student breathed in.

(2)

(b) The student then did some exercise for two minutes. The volume breathed out in five breaths was again measured. This time there was 9000 cm^3 of air in the bag.

STEMUP.CO.UK

What does this tell you about the effect of exercise on breathing?

_____

_____

(1)

(c) (i) Name the chemical process that releases energy when it takes place in the cells of the body.

_____

(1)

(ii) Name the substances produced by this process.

_____ and _____

(2)

(iii) Explain as fully as you can why this process has to take place more rapidly during exercise.

_____

_____

_____

_____

(2)

(Total 8 marks)

Q8.

(a) Explain, as fully as you can, why respiration has to take place more rapidly during exercise.

_____

_____

_____

(2)

(b) During exercise the process of respiration produces excess heat. Explain how the body prevents this heat from causing a rise in the core (deep) body temperature.

_____

_____

_____

_____

_____

_____

STEMUP.CO.UK

_____

_____

(4)

(Total 6 marks)

Q9.

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?

_____

_____

(1)

(ii) Suggest an explanation for this relationship.

_____

_____

_____

_____

_____

_____

(3)

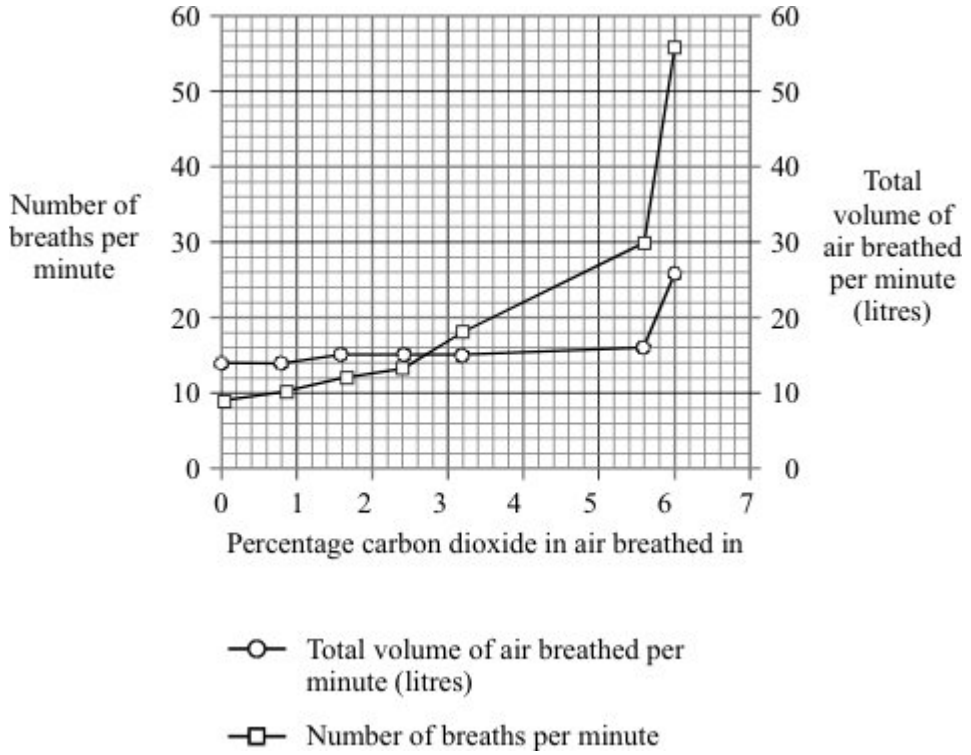
(Total 4 marks)

Q10.

The graph shows the effect of increasing the carbon dioxide content of the inhaled air on:

- the number of breaths per minute;
- the total volume of air breathed per minute.

STEMUP.CO.UK



(i) Describe the effect of increasing the percentage of carbon dioxide in the inhaled air on the total volume of air breathed.

_____

_____

_____

_____

(2)

(ii) Suggest why the total volume of inhaled air is **not** directly proportional to the number of breaths per minute.

_____

_____

_____

_____

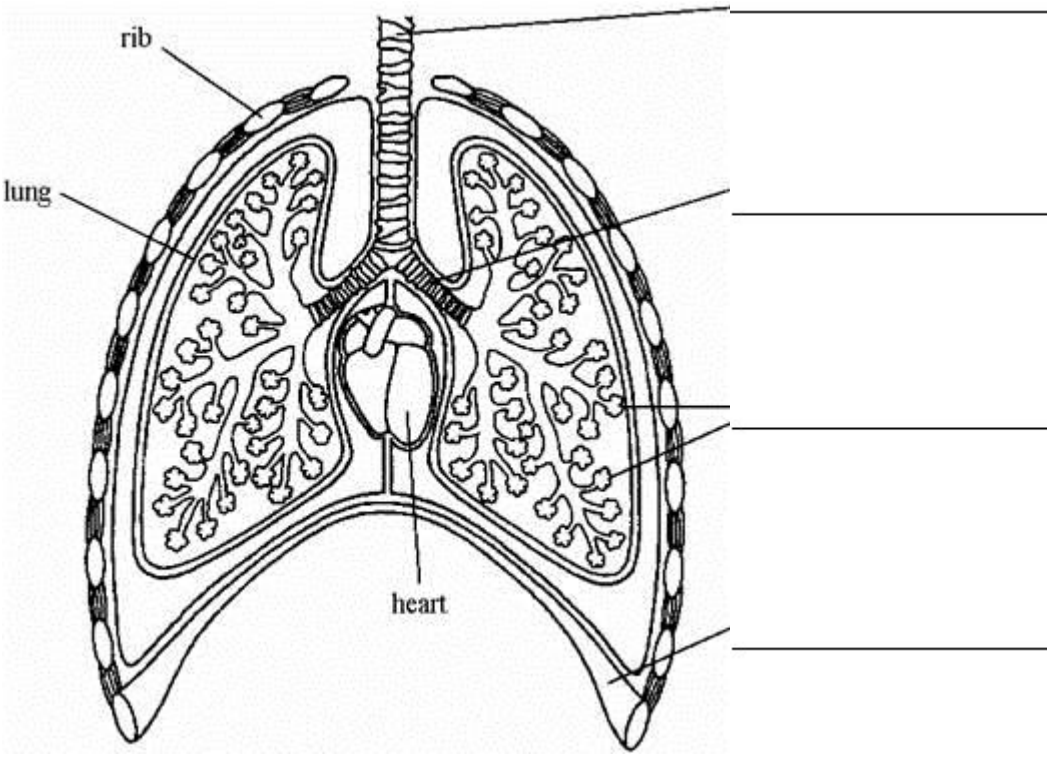
(2)

(Total 4 marks)

Q11.

The diagram shows part of the breathing system in a human.

STEMUP.CO.UK



(a) Use words from the list to label the parts on the drawing.

alveoli **bronchiole** **bronchus** **diaphragm** **trachea (windpipe)**

(4)

(b) Where in the lungs does oxygen enter the blood?

_____

(1)

(c) Which process in cells produces carbon dioxide?

_____

(1)

(Total 6 marks)

Q12.

Read the passage.



Glutton up a gum tree

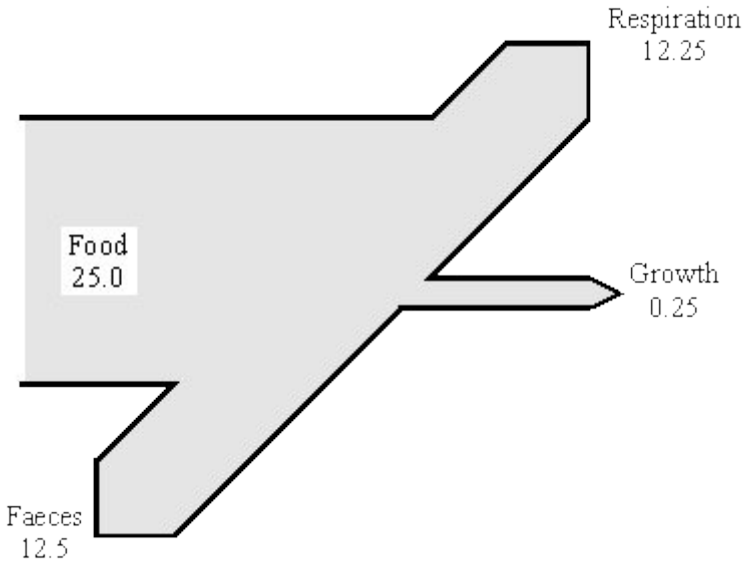
Along the banks of the Cygnet River on Kangaroo Island, the branches of the dying gum trees stretch out like accusing fingers. They have no leaves. Birds search in vain for nectar-bearing flowers.

STEMUP.CO.UK

The scene, repeated mile upon mile, is an ecological nightmare. But, for once, the culprit is not human. Instead, it is one of the most appealing mammals on the planet – the koala. If the trees are to survive and provide a food source for the wildlife such as koalas that depend on them, more than 2000 koalas must die. If they are not removed the island's entire koala population will vanish.

Illegal killing has already started. Worried about soil erosion on the island, some farmers have gone for their guns. Why not catch 2000 koalas and take them to the mainland? "Almost impossible," says farmer Andrew Kelly. "Four rangers tried to catch some and in two days they got just six, and these fought, bit and scratched like fury."

The diagram shows the flow of energy through a koala.
The numbers show units of energy.



(i) Calculate the percentage of the food intake which is converted into new tissues for growth. Show your working.

_____ %

(2)

(ii) Give **three** different ways in which the koala uses the energy released in respiration.

1. _____

_____

2. _____

_____

3. _____

_____

(3)

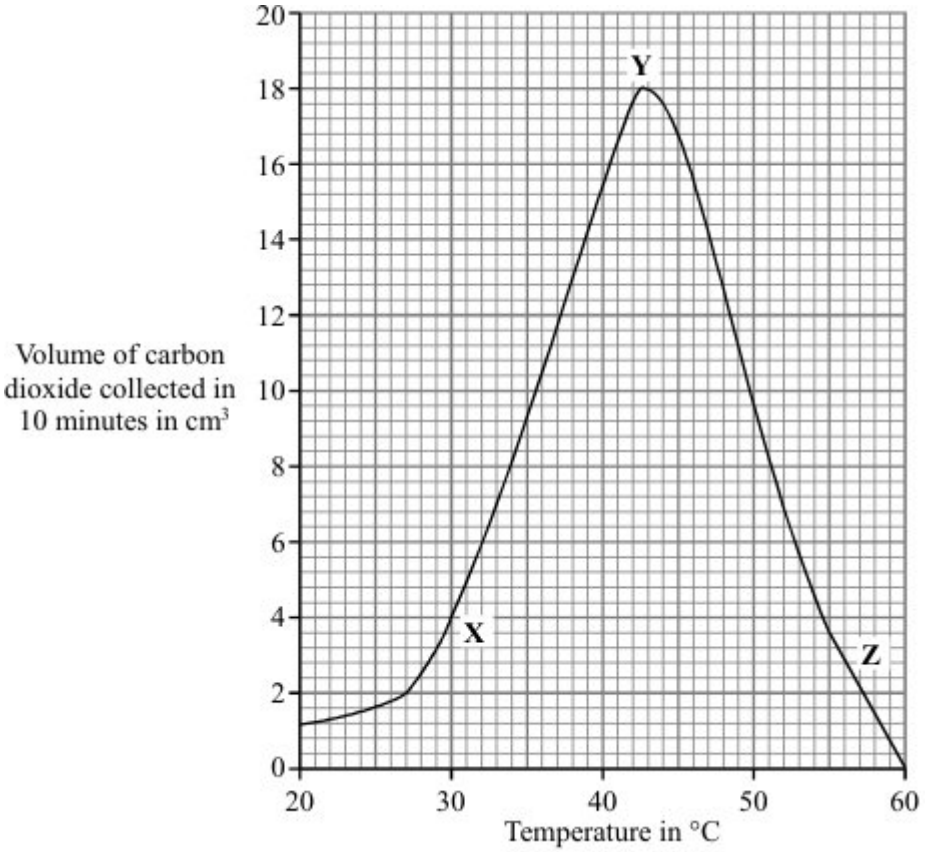
STEMUP.CO.UK

(Total 5 marks)

Q13.

Fermentation of sugar by yeast produces carbon dioxide.

The graph shows the effect of temperature on the production of carbon dioxide by fermentation.



(a) By how much did the volume of carbon dioxide collected change when the temperature was raised from 30°C to 40°C?

_____ cm^3

(1)

(b) Complete the sentences to explain the shape of the curve between **X** and **Y**.

Raising the temperature _____ the speed of the reacting particles.

These particles collide more _____ and more _____ .

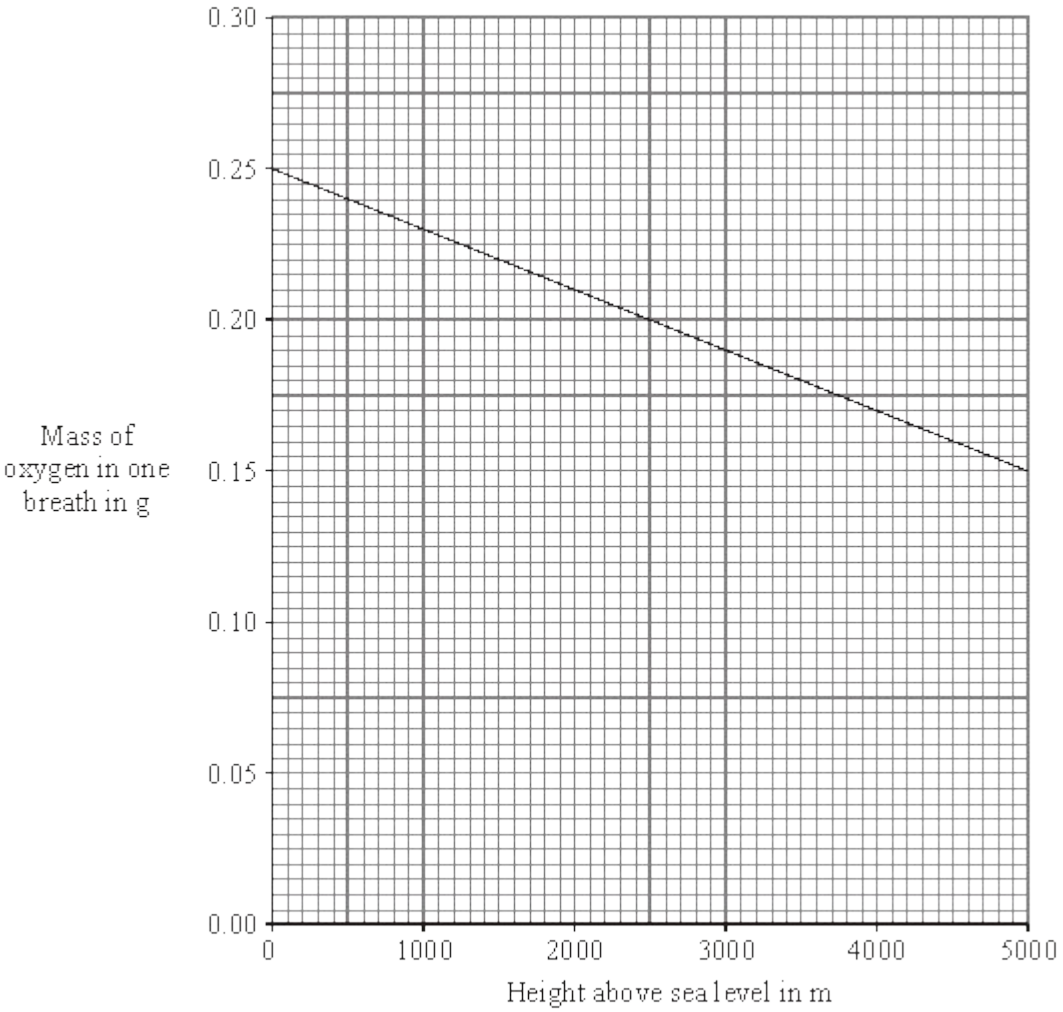
(3)

(Total 4 marks)

Q14.

(a) The graph shows how the mass of oxygen you breathe in changes as you climb up a mountain.

STEMUP.CO.UK



Describe, in as much detail as you can, how the mass of oxygen in one breath changes as you climb from sea level to 3000 m.

_____

_____

_____

_____

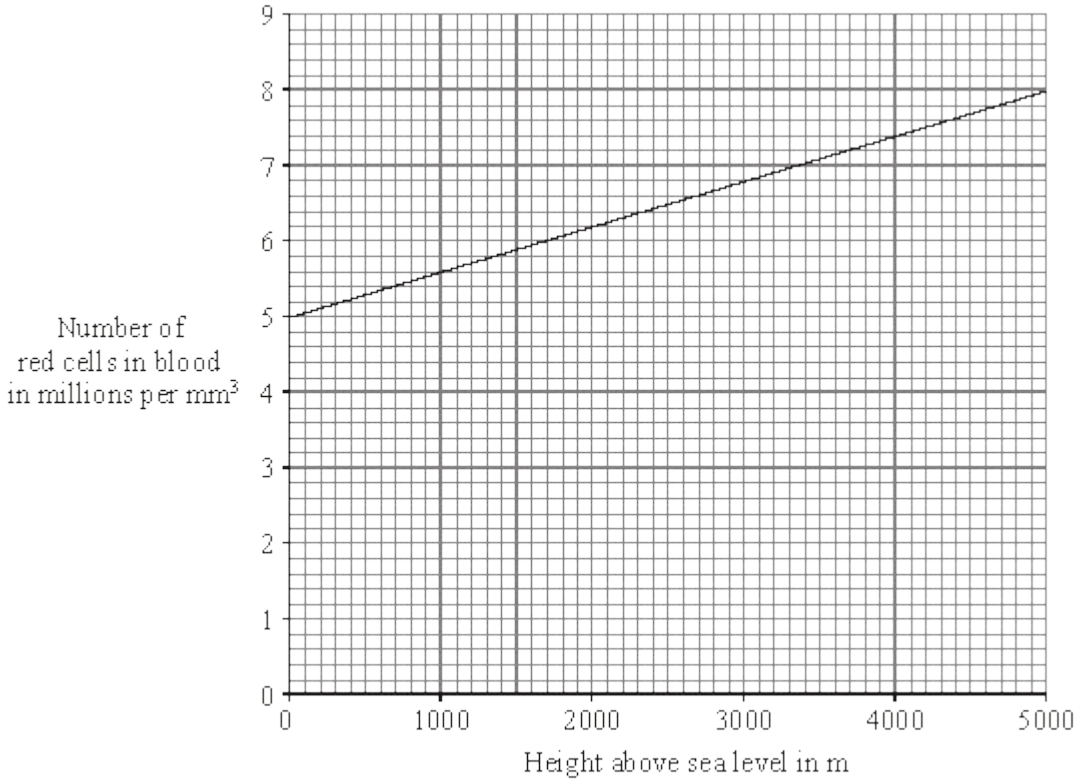
_____

_____

(3)

(b) People who live high up in mountainous areas have more red blood cells than people who live at sea level. The graph below shows how the number of red blood cells changes with height above sea level.

STEMUP.CO.UK



(i) How many more red blood cells does a person living at 3000 m above sea level have than someone living at sea level? Show clearly how you work out your answer.

_____

_____

Increase in number of red blood cells = _____ millions per m^3

(2)

(ii) What is the advantage of having more red blood cells?

_____

_____

(1)

(Total 6 marks)

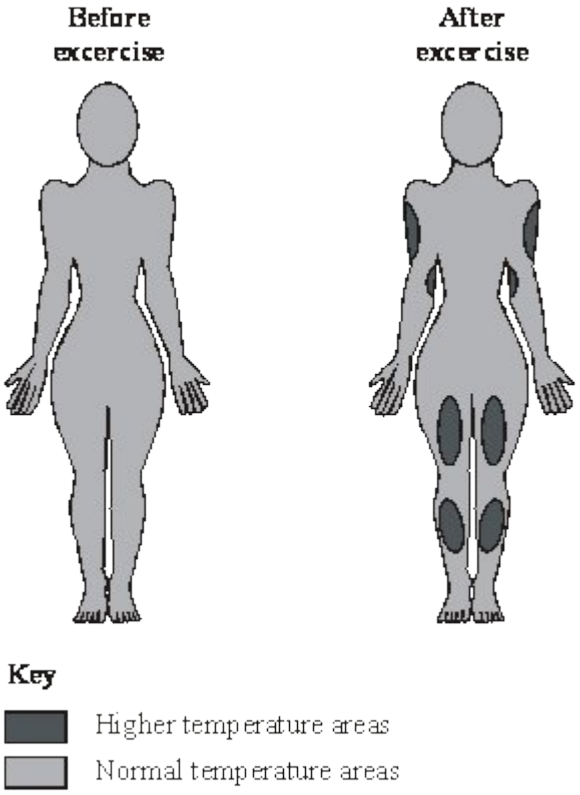
Q15.

The temperature at the surface of the skin can be measured by using a technique called thermography.

In this technique, areas with higher temperature appear as a different colour on the thermographs.

The drawings below show the results of an investigation in which thermographs were taken from a person before and after exercise.

STEMUP.CO.UK



Describe and explain, as fully as you can, the effects of exercise on skin temperature.

_____

_____

_____

_____

_____

_____

_____

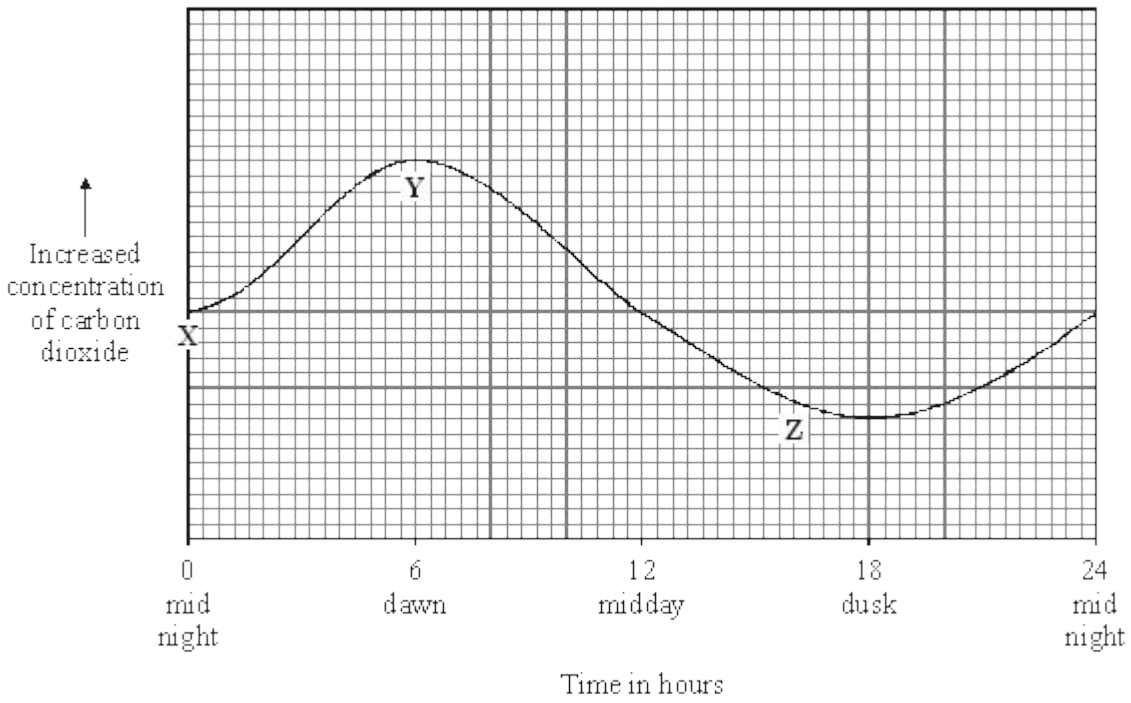
_____

(Total 3 marks)

Q16.

The graph shows the concentration of carbon dioxide in the air in a greenhouse full of tomato plants, measured over a period of 24 hours.

STEMUP.CO.UK



(a) Explain why the concentration of carbon dioxide in the air in the greenhouse increased between **X** and **Y**.

_____

_____

_____

_____

(2)

(b) Explain why the concentration of carbon dioxide in the air in the greenhouse decreased between **Y** and **Z**.

_____

_____

_____

_____

(2)

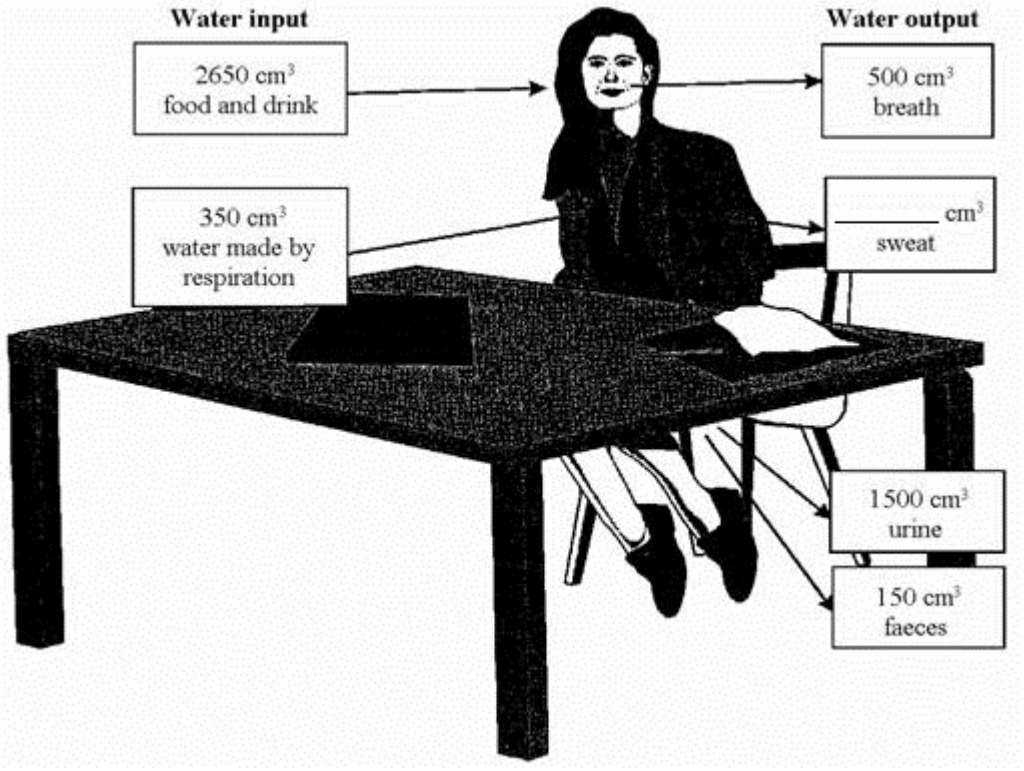
(Total 4 marks)

Q17.

The diagram shows a water balance for a girl who spends most of the day working at a desk. It is not complete.

(a) Complete the diagram by writing in the volume of sweat produced.

STEMUP.CO.UK



(1)

(b) The next day she spent much of the day training, doing many different types of exercise.

State how **each** of the following would change and why it would be different from the previous day.

(i) The amount of water given off as sweat.

_____

_____

_____

(2)

(ii) The amount of water breathed out.

_____

_____

_____

(2)

(iii) The amount of urine passed, if she had the same water intake as on the previous day.

_____

_____

_____

STEMUP.CO.UK

(2)

(c) Which organ controls the amount of water in the body?

_____

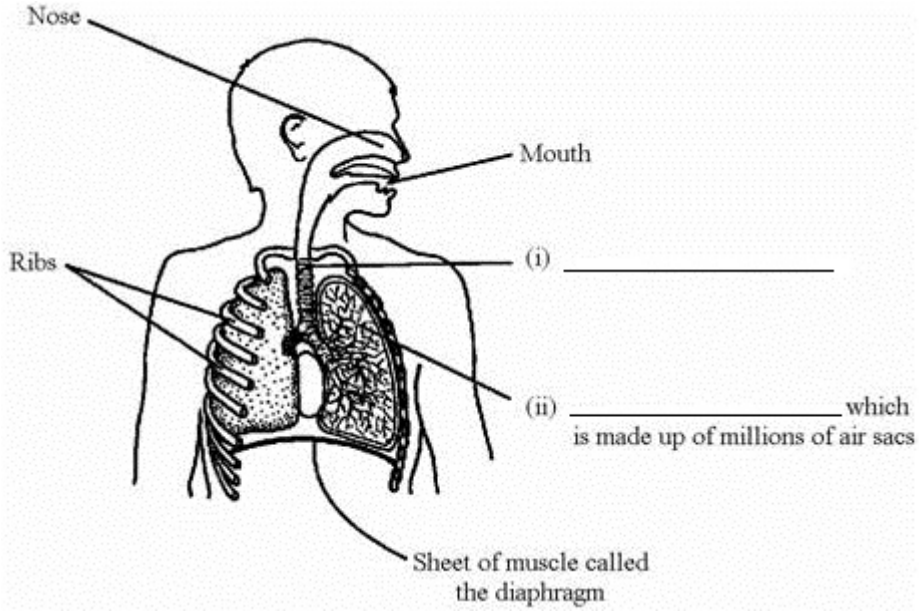
(1)

(Total 8 marks)

Q18.

The diagram shows the human breathing system.

(a) Complete the labels (i) and (ii).



(2)

(b) Complete the following sentence.

When we breathe out, the mixture of gases which leaves the air sacs contains **more** _____ and **less** _____ than the mixture of gases which enters the air sacs.

(2)

(Total 4 marks)

Q19.

(i) What is the name of the process which takes place in living cells in your body and which releases energy from oxygen and glucose?

_____

(1)

(ii) Name the **two** products of the process in part (i).

_____ and _____

(1)

STEMUP.CO.UK

(Total 2 marks)

Q20.

(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)

Q21.

Oxygen from our lungs is carried, by our blood, to cells in our body where aerobic respiration takes place.

(i) Complete the **two** spaces to balance the chemical reaction for aerobic respiration.

$$C_6H_{12}O_6 + 6O_2 \rightarrow ____ CO_2 + ____ H_2O$$

(1)

(ii) Name the substance with the formula $C_6H_{12}O_6$.

_____

(1)

(iii) Name the structures in the cytoplasm of our cells where aerobic respiration takes place.

_____

(1)

(Total 3 marks)

Q22.

A young athlete trains and this makes her heart work harder. The table shows part of her training record.

Time measured in weeks from	0	8	16	24	32	40

STEMUP.CO.UK

the start of training						
Resting pulse rate measured in pulses per minute	75	69	66	63	61	60

(i) Give **two** changes to her heart resulting from this training.

1. _____

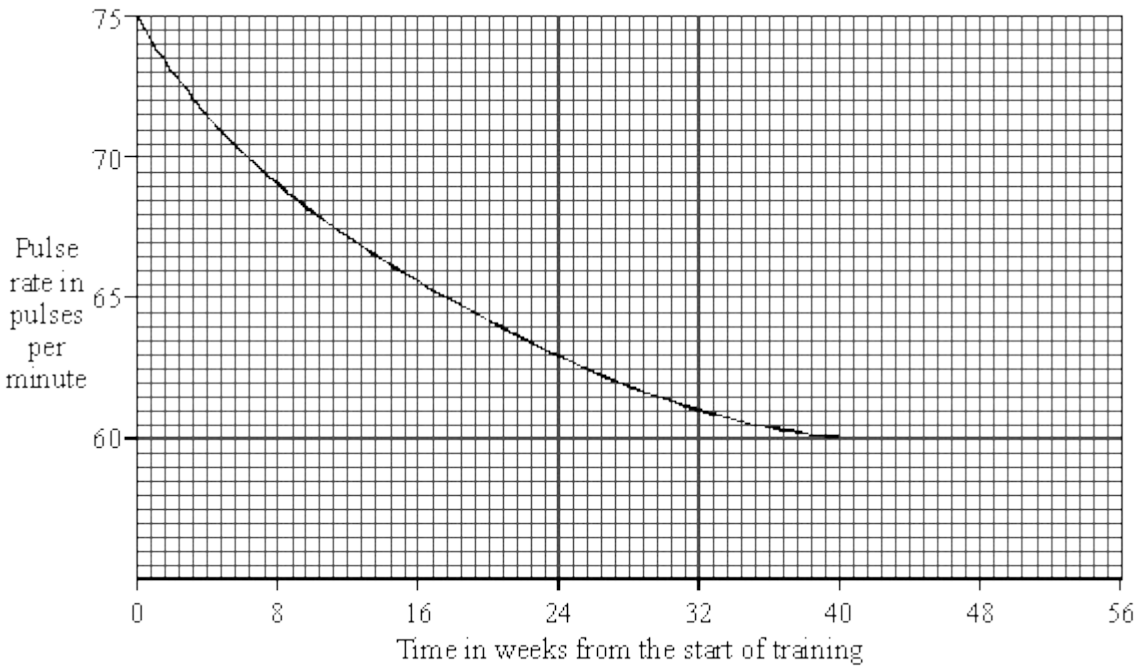
_____

2. _____

_____

(2)

(ii) The graph shows a smooth curve drawn to match the data from her training record.



Use the graph:

(A) to estimate her resting pulse rate, in pulses per minute, after 18 weeks of training;

_____

(1)

(B) to predict her resting pulse rate, in pulses per minute, if she continues her training until the end of the year.

_____

(1)

(Total 4 marks)

Q23.

STEMUP.CO.UK

(a) The air you breathe in and the air you breathe out are different.

Use the names of gases from this box to complete the **three** spaces.

argon	carbon dioxide	nitrogen	oxygen	water vapour

Compared to the air you breathe in, the air you breathe out contains:

- **more** _____
- **more** _____
- **less** _____

(3)

(b) The process of aerobic respiration takes place in your cells.

(i) Complete the space in the word equation for this process.

_____ + oxygen → carbon dioxide + water

(1)

(ii) Complete the space to give the main energy transfer which takes place in this process.

chemical energy → _____ energy

(1)

(iii) What is the name of the organ where oxygen from the air passes to your blood?

_____

(1)

(c) The athlete is taking part in vigorous exercise.



STEMUP.CO.UK

Complete the **two** spaces in the passage.

The cells in our muscles respire anaerobically during vigorous exercise. This results in _____ debt and the production of _____ acid.

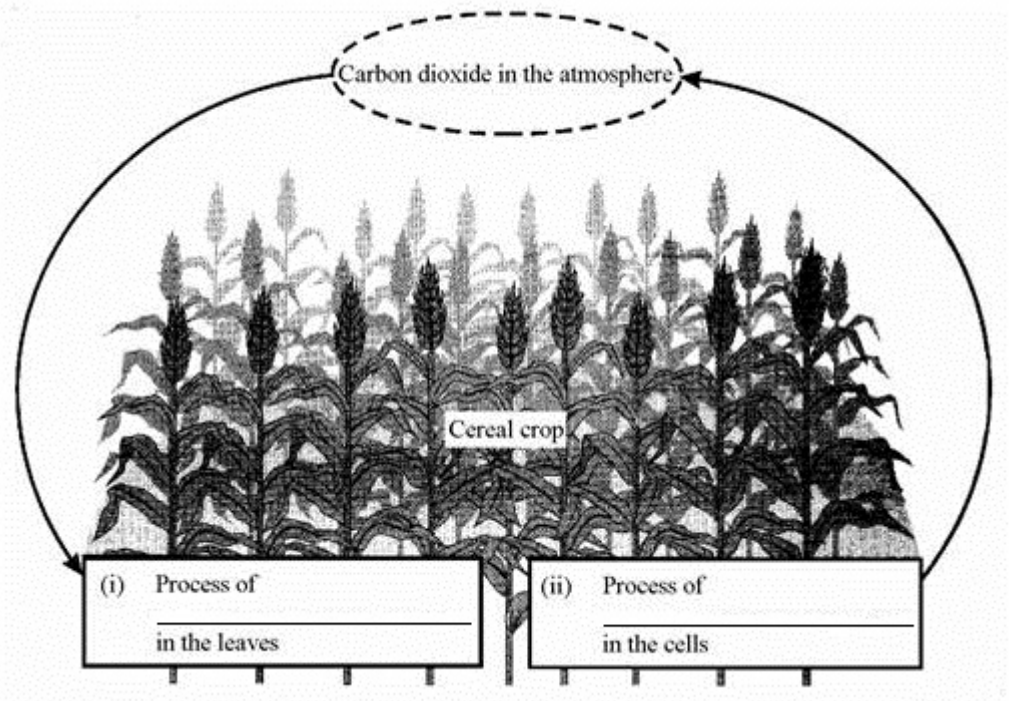
(2)

(Total 8 marks)

Q24.

(a) The diagram shows a cereal crop.

Complete spaces (i) and (ii).



(2)

(iii) What sort of weather may cause the cereal crop to wilt?

_____

(1)

(b) Describe the process of transpiration in plants.

_____

_____

_____

_____

_____

_____

(3)

(Total 6 marks)

STEMUP.CO.UK

Q25.

The man uses energy as he walks along. Energy is released in the cells in his body.

(i) What name is given to this process which occurs in his cells?

Circle the correct name.

circulation **reproduction** **respiration** **transpiration**

(1)

(ii) What gas is brought to his cells by the blood?

_____

(1)

(iii) What gas is released by his cells and carried away by the blood?

_____

(1)

(Total 3 marks)

Q26.

(a) Respiration is a process which takes place in living cells. What is the purpose of *respiration*?

_____

_____

(1)

(b) (i) Balance the equation for the process of respiration when oxygen is available.

$C_6H_{12}O_6$ + O_2 → CO_2 + H_2O

(1)

(ii) What is the name of the substance in the equation with the formula $C_6H_{12}O_6$?

_____

(1)

(c) Oxygen is absorbed through the alveoli in the lungs.

(i) How are the alveoli adapted for this function?

_____

_____

_____

(2)

(ii) Name the gas which is excreted through the alveoli.

_____

(1)

STEMUP.CO.UK

(d) (i) What is the name of the process of respiration when oxygen is **not** available?

_____

(1)

(ii) Describe the process of respiration which takes place in human beings when oxygen is **not** available and give an effect.

_____

_____

_____

_____

_____

_____

(3)

(Total 10 marks)

Q27.

Plants need chemical energy for respiration and for active transport.

(i) Write a balanced chemical equation which represents the process of respiration in plants.

_____

(2)

(ii) Describe the process of active transport in the root hair cells of plants.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 5 marks)

STEMUP.CO.UK

Q28.

The table shows the percentage of some gases in the air a boy breathed in and out.

Gases	Air breathed in	Air breathed out
carbon dioxide	0.04%	4.0%
oxigen	20.0%	16.0%
water vapour	1.0%	6.0%

(a) What happens in the lungs to change the levels of oxygen and carbon dioxide in this way?

Oxygen _____

_____

_____

Carbon dioxide _____

_____

_____

(4)

(b) Compare the percentage of water vapour in the air breathed out with the percentage in air breathed in.

_____

(2)

(Total 6 marks)

Q29.

Diagram 1 shows the main features of human blood circulation.

STEMUP.CO.UK

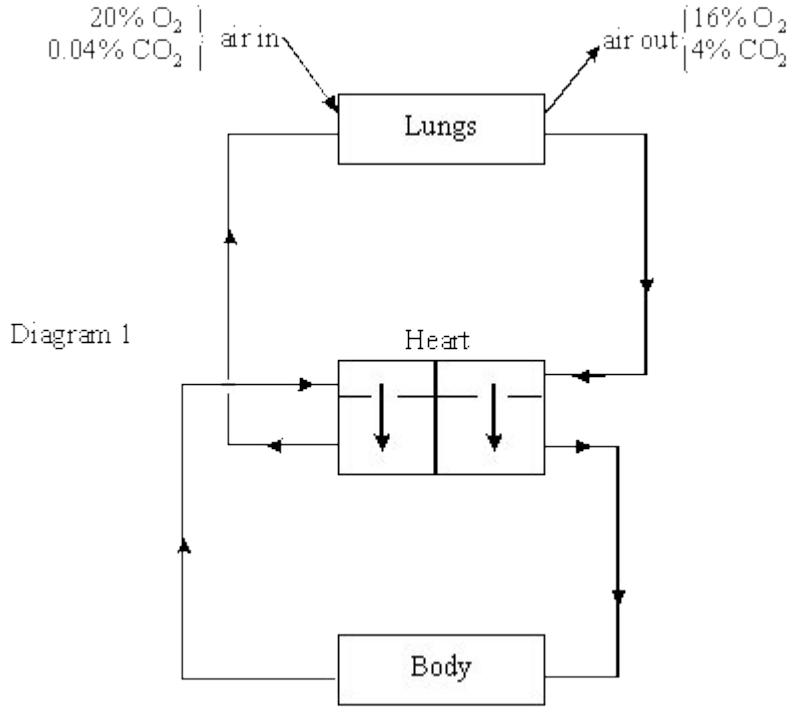


Diagram 1

(a) What changes in the composition of **blood** occur in the lungs?

_____

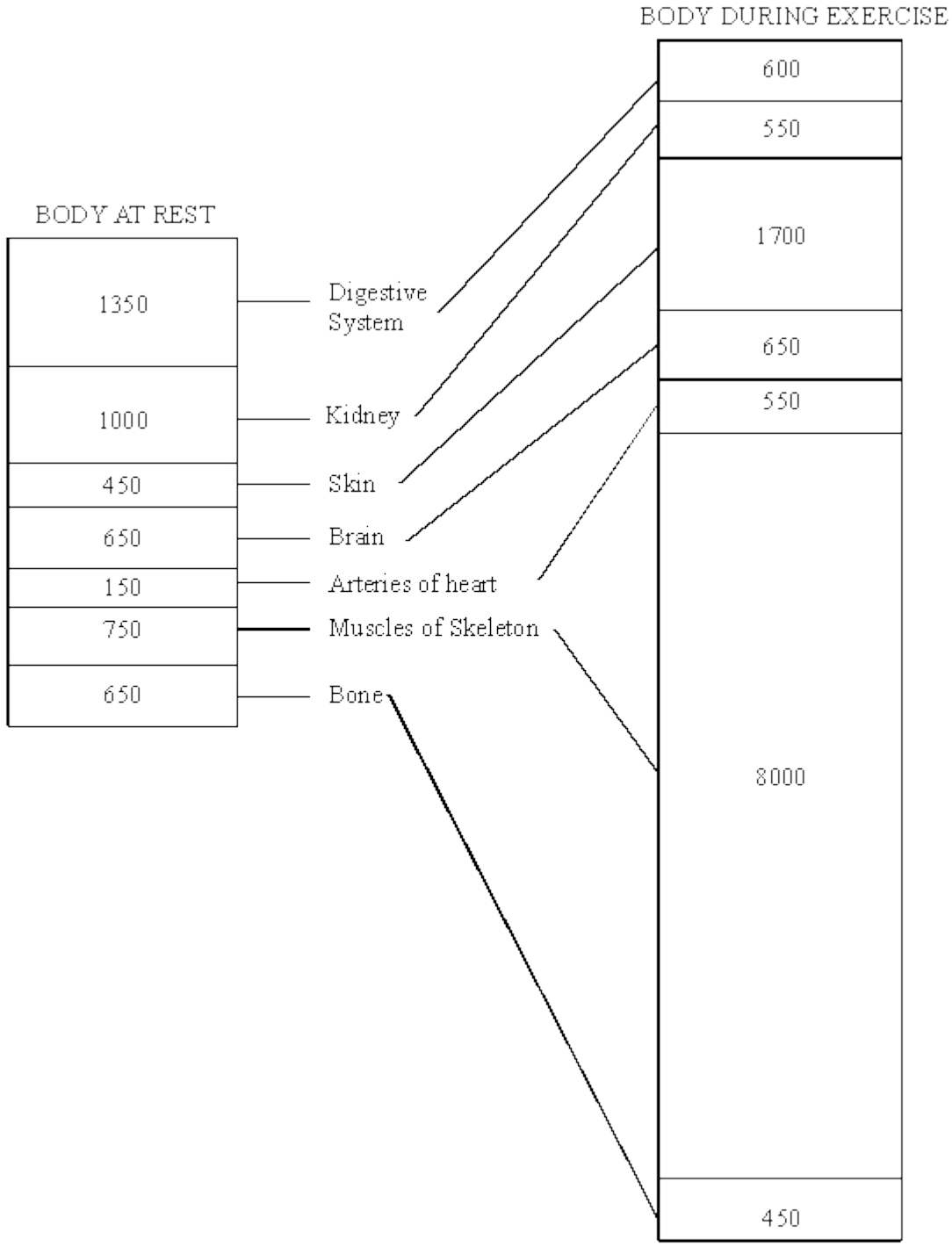
_____

_____

(2)

Diagram 2 shows how the circulation of blood changes between rest and exercise.

STEMUP.CO.UK



Rate of supply of blood to parts of the body (cm^3/min) when at rest and during exercise.

(b) (i) Use the information from Diagram 2 to complete the table below.

Parts of the body to be included:

Digestive System

Skin

Brain

Arteries of Heart

Muscles of Skeleton

Bone

STEMUP.CO.UK

HOW BLOOD SUPPLY CHANGES DURING EXERCISE		
reduced	unchanged	increased
Kidney		

(4)

(ii) What happens to the rate of supply of blood to the whole body with exercise?

(You should make full use of the information provided.)

_____

_____

_____

(3)

(Total 9 marks)

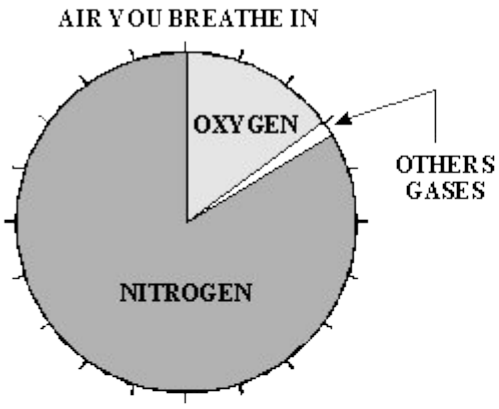
Q30.

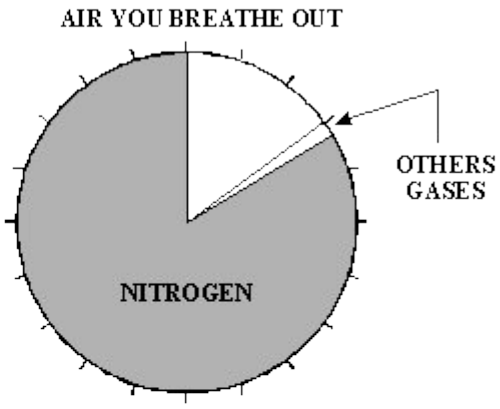
(a) Breathed-out air is different from breathed-in air.

The two pie-charts show the percentages of different gases in each.

Complete the second pie-chart, using the information from the table.

STEMUP.CO.UK





This air contains less than 1% carbon dioxide. (Too little to show)

Gases in breathed–out air	
nitrogen	79%
oxygen	16%
carbon dioxide	4%
other gases	1%

(3)

(b) Use the information above to complete the following sentences.

The air you breathe out contains more _____ than the air you breathe in.

The air you breathe out contains less _____ than the air you breathe in.

(2)

(Total 5 marks)

Q31.

As they go higher up a mountain, mountaineers take less oxygen into their bodies with each breath.



This is shown in the table below.

	MILLIGRAMS OF OXYGEN TAKEN INTO **LUNGS** WITH EACH NORMAL BREATH	MILLIGRAMS OF OXYGEN TAKEN INTO **BLOOD** WITH EACH NORMAL BREATH

STEMUP.CO.UK

At bottom of mountain	300	60
At top of mountain	150	30

(a) At the top of the mountain, they only take half as much oxygen into their lungs with each breath as they did at the bottom.

How does this affect the amount of oxygen that gets into their blood with each breath?

_____

_____

(2)

(b) Why do the cells in the mountaineers' bodies need oxygen?

_____

_____

(1)

(Total 3 marks)

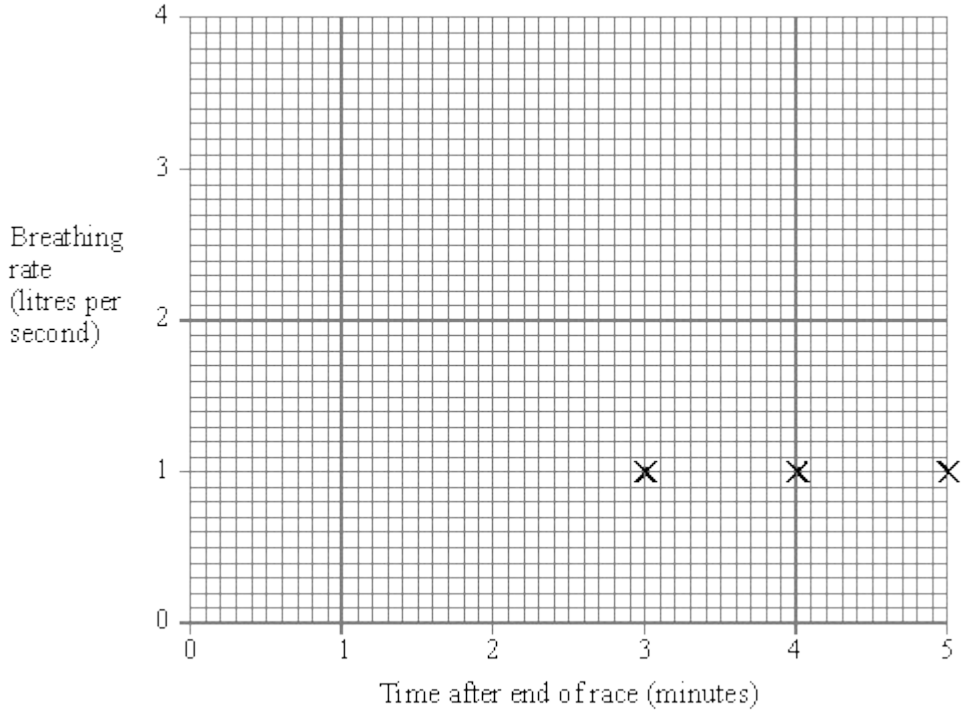
Q32.

(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.

Time after end of race (minutes)	Breathing rate (litres per second)
0	4
1	2
2	1
3	1
4	1
5	1

STEMUP.CO.UK



(4)

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

_____

(2)

(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.

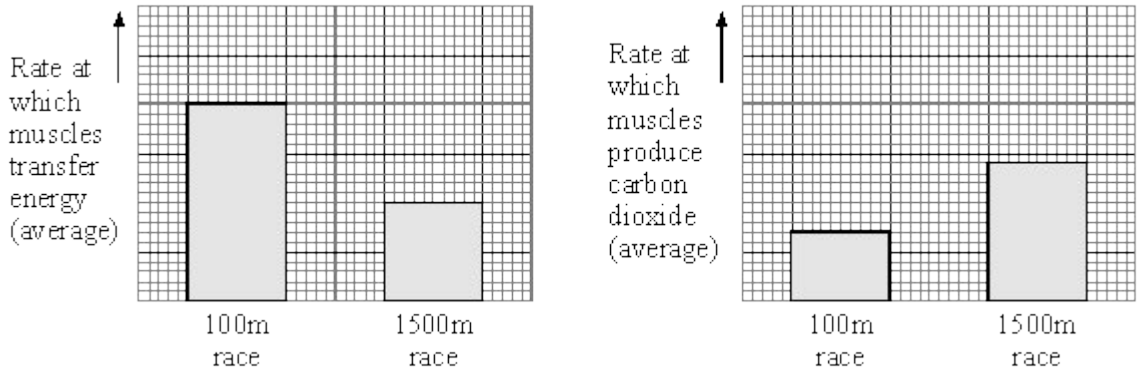
blood **heart** **kidneys** **lungs** **urine**

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.

STEMUP.CO.UK

_____

_____

_____

_____

(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

_____

_____

(2)

(Total 13 marks)

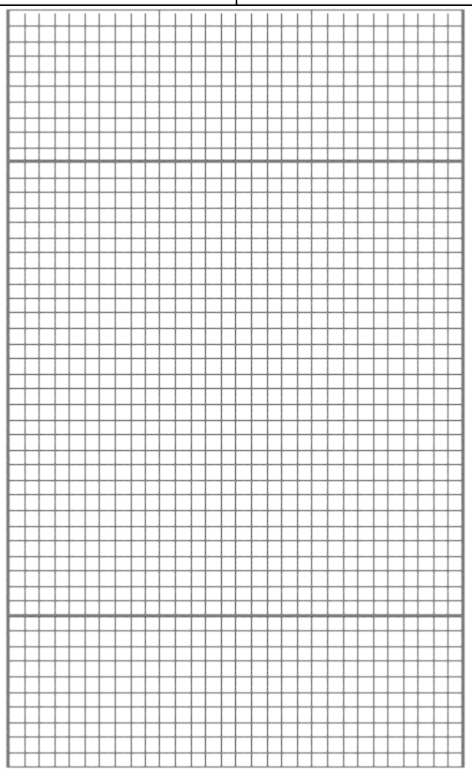
Q33.

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

Use the information shown in the table to draw a line graph.

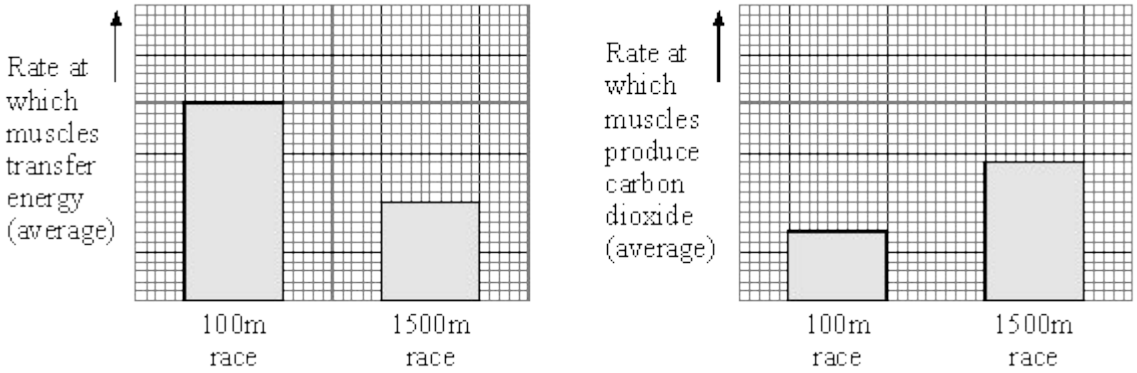
STEMUP.CO.UK

Time after end of race (minutes)	Breathing rate (litres per second)
0	4
1	2
2	1
3	1
4	1
5	1



(3)

(b) 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.

_____

_____

(3)

STEMUP.CO.UK

(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

_____

_____

(2)

(c) Explain why the athlete breathes at a faster rate than normal for two minutes after finishing a 100 metres race.

_____

_____

_____

(2)

(Total 10 marks)

STEMUP.CO.UK