Exercise and respiration 3

Name: _____

Class: _____

Date: _____

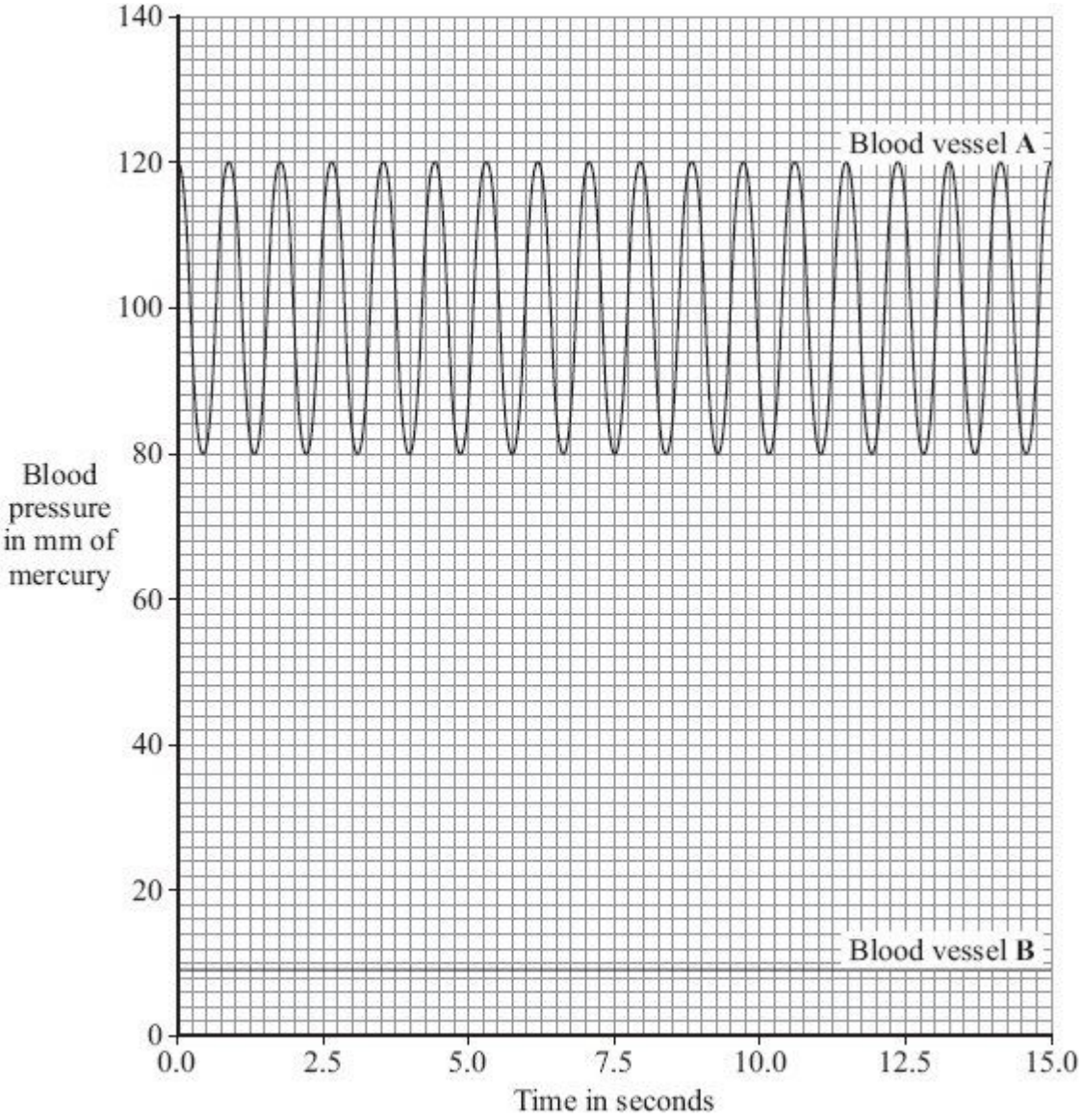
Time: **45 minutes**

Marks: **45 marks**

Comments:

1. The heart pumps blood around the body. This causes blood to leave the heart at high pressure.

The graph shows blood pressure measurements for a person at rest.
The blood pressure was measured in an artery and in a vein.



(a) Which blood vessel, **A** or **B**, is the artery?

Blood vessel _____

Give **two** reasons for your answer.

Reason 1 _____

_____

Reason 2 _____

_____

(2)

(b) Use information from the graph to answer these questions.

(i) How many times did the heart beat in 15 seconds? _____

(1)

(ii) Use your answer from part (b)(i) to calculate the person's heart rate per minute.

_____

_____

Heart rate = _____ beats per minute

(1)

(c) During exercise, the heart rate increases. This supplies useful substances to the muscles and removes waste materials from the muscles at a faster rate.

(i) Name **two** useful substances that must be supplied to the muscles at a faster rate during exercise.

1. _____

2. _____

(2)

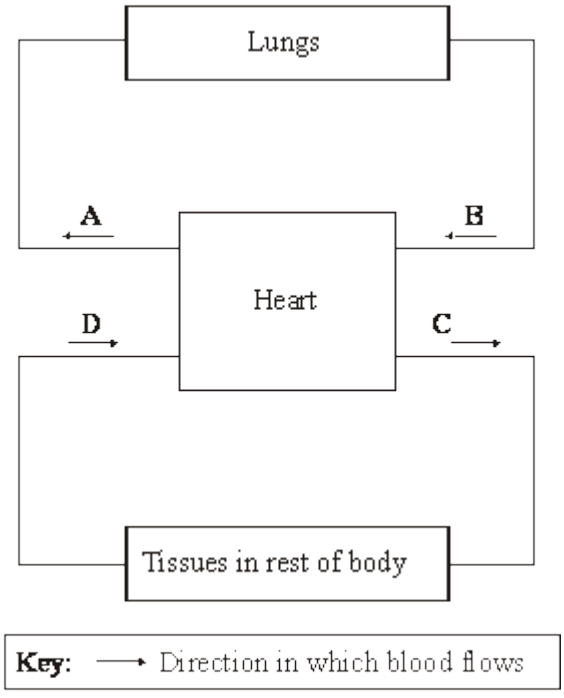
(ii) Name **one** waste substance that must be removed from the muscles at a faster rate during exercise.

_____

(1)

(Total 7 marks)

2. The diagram represents the human blood circulation system.



(a) **A**, **B**, **C** and **D** are blood vessels.

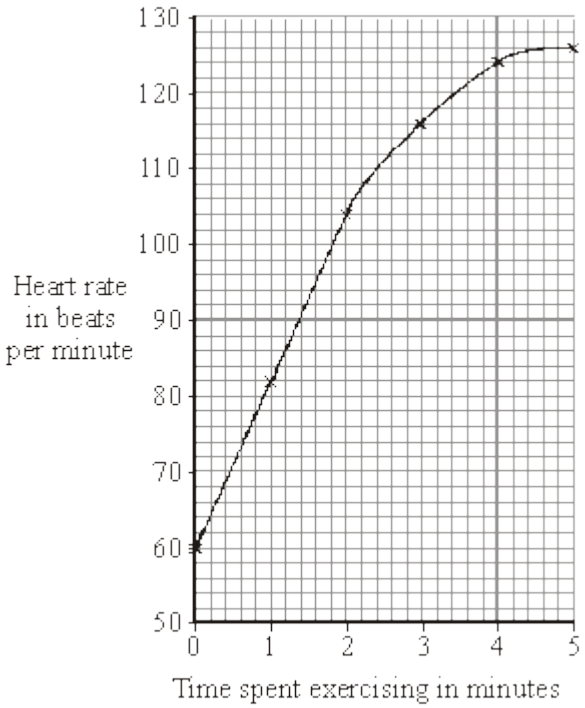
(i) Give the letter of **one** blood vessel that is an artery. _____

(1)

(ii) Give the letter of **one** blood vessel that is a vein. _____

(1)

(b) A student pedalled an exercise cycle at constant speed for 5 minutes. The student's heart rate was recorded at one-minute intervals during the exercise. The results are shown in the graph.



(i) What was the student's heart rate before the exercise began?

_____ per minute

(1)

(ii) How long was it before the student's heart rate reached 124 beats per minute?

_____ minutes

(1)

(c) Which of the following parts of the blood carries most oxygen?

Draw a circle around **one** answer.

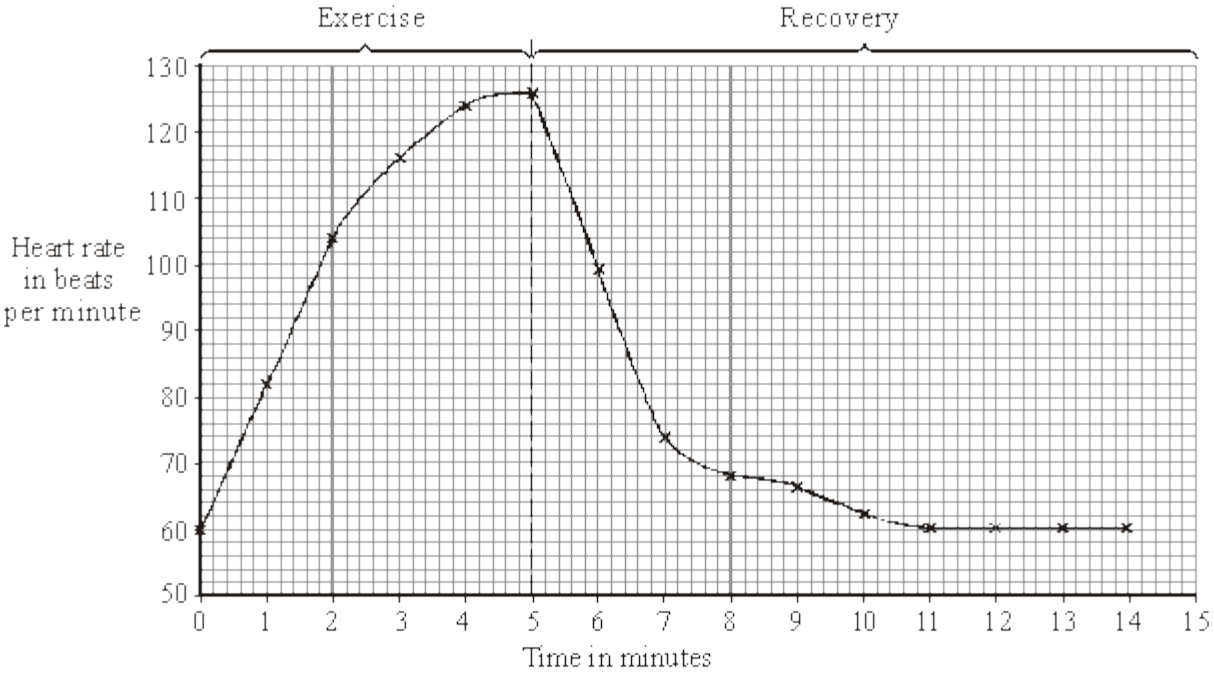
plasma **red blood cells** **white blood cells**

(1)

(Total 5 marks)

3. A student pedalled an exercise cycle at constant speed for 5 minutes. The student's heart rate was recorded at one-minute intervals during the exercise and also during recovery.

The results are shown in the graph.



(a) Describe, in as much detail as you can, the changes in heart rate between 0 and 14 minutes.

_____

_____

_____

_____

_____

_____

_____

(3)

(b) How do arteries supplying the leg muscles alter the rate of blood flow through them during exercise?

_____

_____

(1)

(c) Explain how an increase in heart rate helped the student during exercise.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 8 marks)

4. 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.

_____

_____

_____

_____

_____

_____

_____

_____

(Total 4 marks)

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

Time measured in weeks from the start of training	0	8	16	24	32	40
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. _____

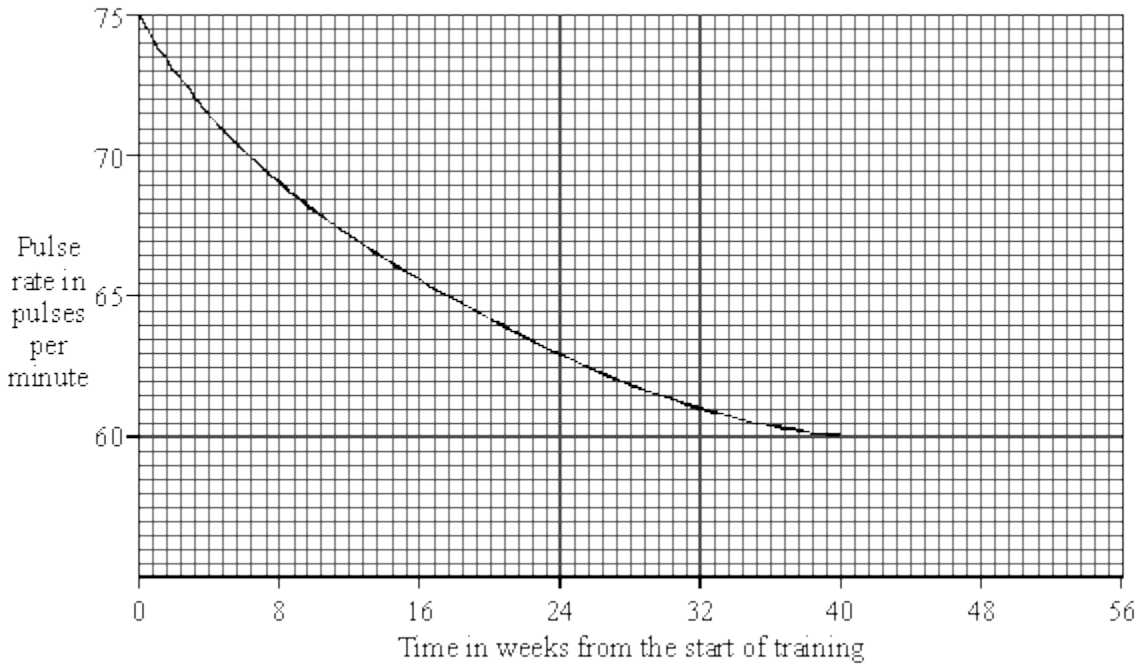
_____

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)

6. (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.

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)

7. Diagram 1 shows the main features of human blood circulation.

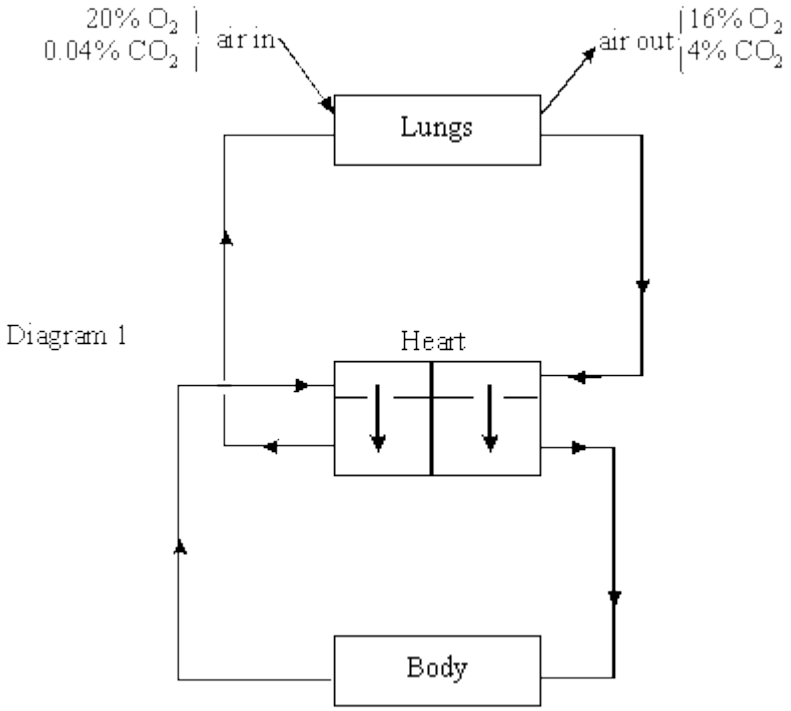


Diagram 1

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

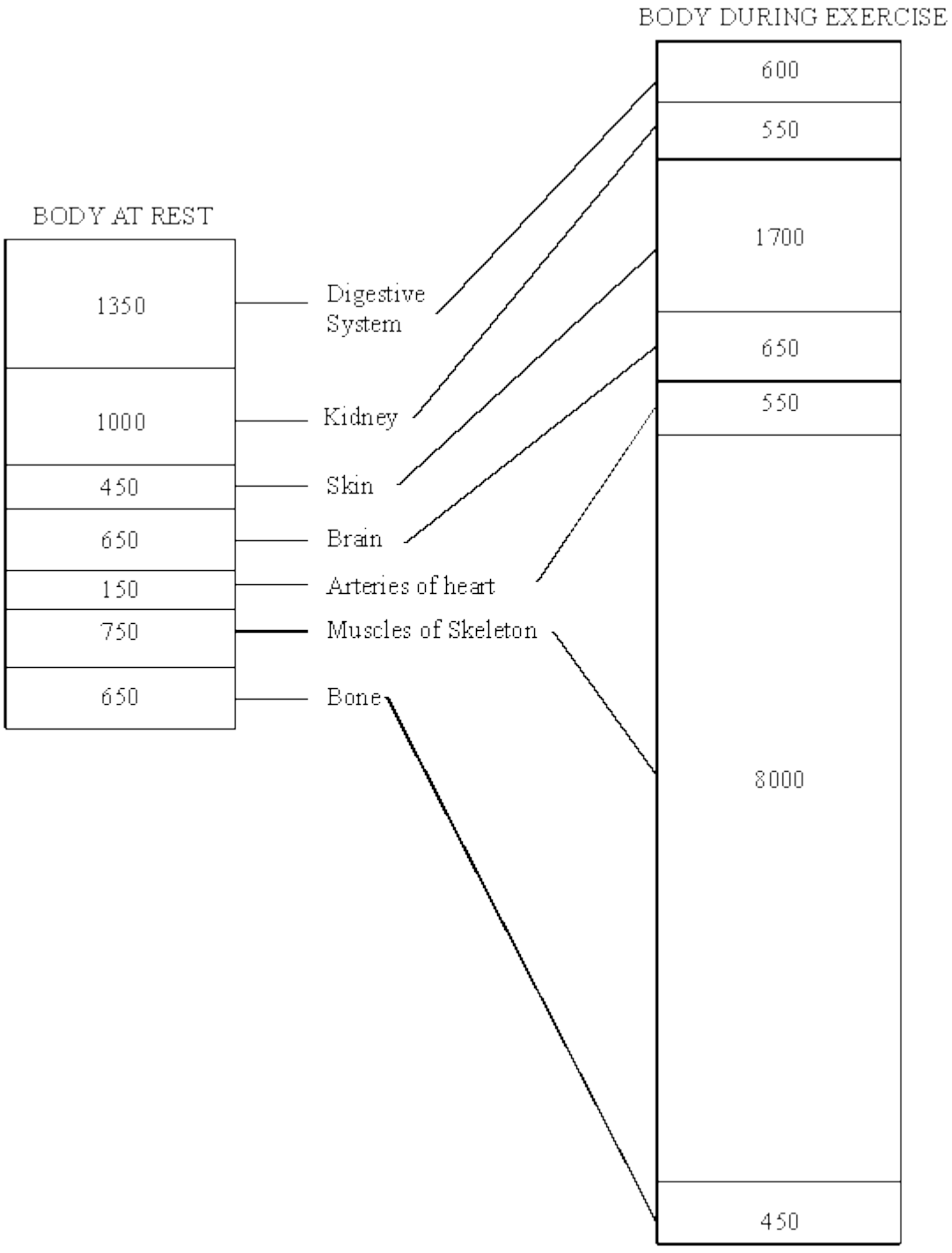
_____

_____

_____

(2)

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



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

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)

Mark schemes

1. (a) A

no mark – can be specified in reason part
if B given = no marks throughout
if unspecified plus two good reasons = 1 mark

high(er) pressure in A

allow opposite for B
do not accept 'zero pressure' for B

1

pulse / described in A

accept fluctuates / 'changes'
allow reference to beats / beating
ignore reference to artery pumping

1

(b) (i) 17

1

(ii) 68

accept correct answer from candidate's (b)(i) × 4

1

(c) (i) oxygen / oxygenated blood

allow adrenaline
ignore air

1

glucose / sugar

extra wrong answer cancels eg
sucrose / starch / glycogen / glucagons / water
allow fructose as an alternative to glucose
ignore energy
ignore food

1

(ii) carbon dioxide / CO_2 / lactic acid

allow CO2 / CO^2
ignore water

1

[7]

2.

(a) (i) A **or** C

allow lower case

1

(ii) B **or** D

allow lower case

1

(b) (i) 60

1

(ii) 4

1

(c) red blood cells

1

[5]

3.

(a) any **three** from:

- rose <u>rapidly</u> (during exercise) / use of approximate figures
- then more slowly (during exercise)

  accept rate (of increase) slows down
- to max 126 / at 5 minutes / end of exercise
- <u>rapid</u> fall (during recovery) **or** use of approximate numbers
- then less rapid fall / use of approximate numbers
- returned to resting rate (60 bpm) by 11 minutes

3

(b) arteries dilate / widen

accept muscle in wall relaxes

1

(c)

any **four** from:

- muscles using more energy **or** more energy released
- muscles <u>respire</u> faster
- supply more oxygen
- supply more glucose / sugar
- remove more CO_2
- remove lactic acid
- remove heat / to cool

do **not** accept energy produced

allow for aerobic respiration **or** to prevent anaerobic respiration

'more' needed ONCE only for full marks

4

[8]

4. any **four** from:

more energy / respiration required

accept it prevents / reduces anaerobic respiration ***or*** *less / no lactic acid*

reference to increase must be made, but only needed once, provided inference is clear for remainder of points.

accept 'delivered more quickly' for 'increase'

increase oxygen uptake into blood (in lungs)

increase oxygen delivery to muscles

increase glucose delivery to muscles

increase removal of heat from muscles **or** increase delivery of heat to skin

increase removal of carbon dioxide from muscles

increase removal of carbon dioxide from blood (in lungs)

[4]

5. (i) any **two** from

* (heart) more muscular

accept bigger

* (heart) more powerful

accept more efficient

accept stronger

2

(ii) * pauses longer between (heart) beats

accepts beats more slowly

accept heart rate decreases

* less fast around the heart

recovers more quickly not just 'heart healthier'

do not credit pulse rate slower

2

[4]

6. (a) more water vapour

accept more water

1

more carbon dioxide

1

less oxygen

1

(b) (i) glucose

accept carbohydrate(s)

accept sugar(s)

1

(ii) heat

or *thermal*

or *internal kinetic*

1

(iii) lungs

accept alveoli / alveolus

do not credit air sacs

do not credit capillaries

both neutral if included with lungs

1

(c) oxygen

accept O_2

1

lactic

1

[8]

7.

(a) *idea*

O_2 increases

CO_2 decreases

for 1 mark each

2

(b) (i)

reduced	unchanged	increased
digestive system	brain	skin
bone		muscles
		heart and arteries

All (6) correct gains 4

5 correct gains 3

4 correct gains 2

2/3 correct gains 1

Correct wording not needed if unambiguous. No mark if organ repeated.

4

(ii) more/higher/quicker/faster

gains 1 mark

but

7500 more/from 5,000 to 12,500 more

gains 2 marks

but

7500 cm^3/min more

gains 3 marks

or 2½ times more

3

[9]