##

(a) The table shows the effect of exercise on the action of one person's heart.

	At rest	**During exercise**
Heart rate in beats per minute	72	165
Volume of blood leaving the heart in each beat in cm^3	75	120
Heart output in cm^3 per minute	5400	

(i) Calculate the heart output for this person during exercise.

Show clearly how you work out your answer.

.....

.....

.....

.....

Answer = ... cm^3 per minute

(2)

(ii) During exercise, more oxygen is carried to the working muscles.

Explain why this is helpful during exercise.

.....

.....

.....

.....

.....

(2)

(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 .....

.....

(2)

(Total 6 marks)

Q2. Paula is training for a marathon. When she runs, her heart beats faster than it does when she is resting.

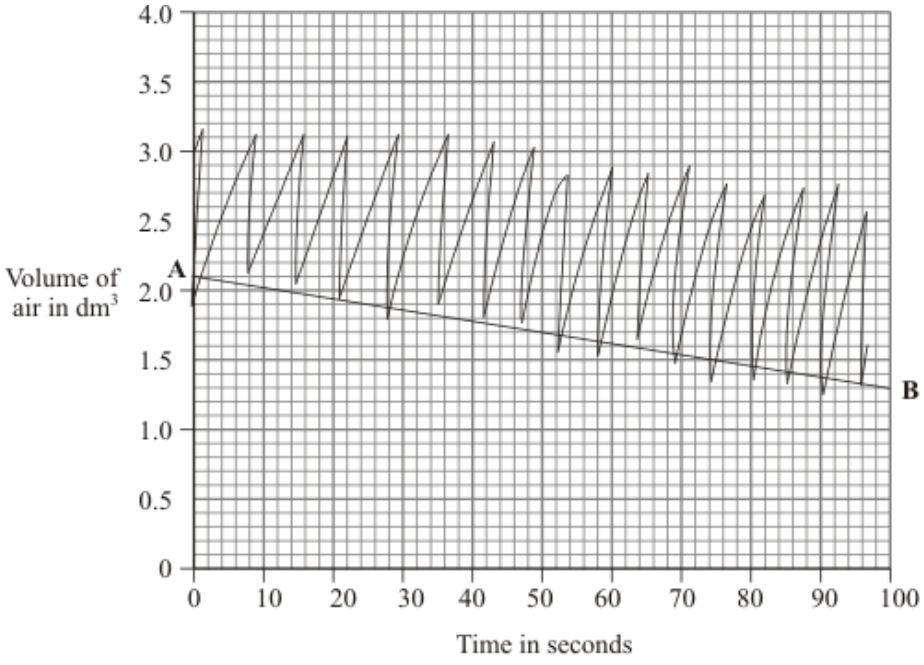
Complete the sentences, using words from the box.

blood	**breathe**	**carbon dioxide**	**glucose**	
heat	**nitrogen**	**oxygen**	**respire**	

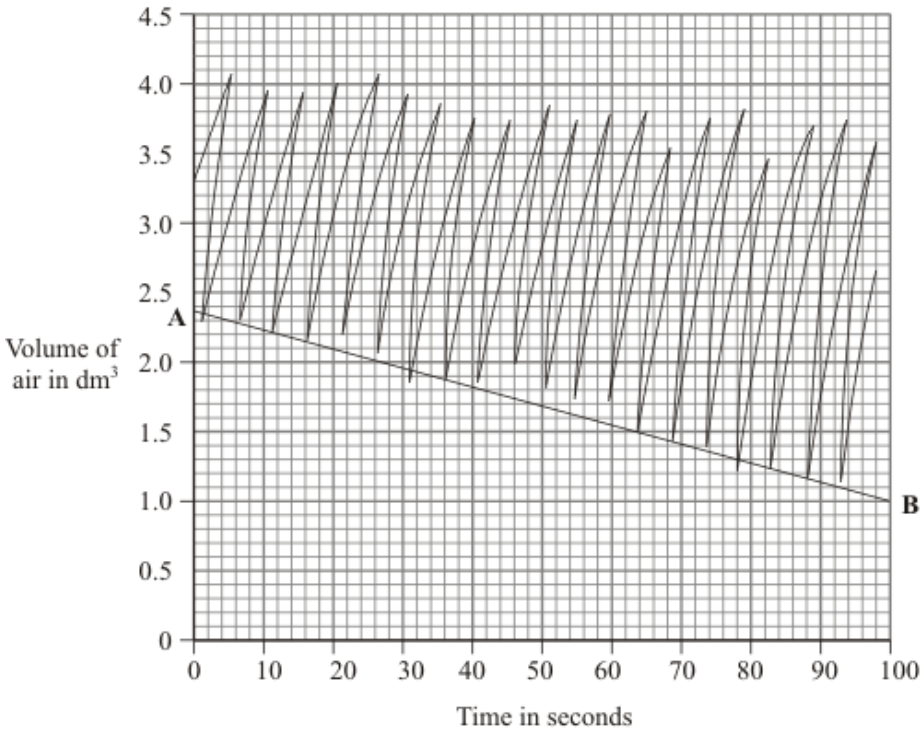
When she is running, Paula's muscle activity increases. To do this, her muscle cells ..... at a faster rate to give her more energy. Her muscles need to be supplied with ..... and ..... more quickly. Her heart beats faster to increase the flow of..... which carries the products ..... and ..... away from her muscles.

(Total 6 marks)

Q3. A student's breathing was monitored before and after vigorous exercise. The student breathed in and out through a special apparatus. The graphs show the changes in the volume of air inside the apparatus. Each time the student breathed in, the line on the graph dropped. Each time the student breathed out, the line went up.



Before exercise



After exercise

(a) How many times did the student breathe in per minute:

before exercise; .....

after exercise? .....

(1)

(b) On each graph, the line **A** – **B** shows how much oxygen was used. The rate of oxygen use before exercise was 0.5 dm^3 per minute. Calculate the rate of oxygen use after exercise.

.....

.....

.....

Rate of oxygen use after exercise = ... dm^3 per minute

(2)

(c) The breathing rate and the amount of oxygen used were still higher after exercise, even though the student sat down to rest. Why were they still higher?

.....

.....

.....

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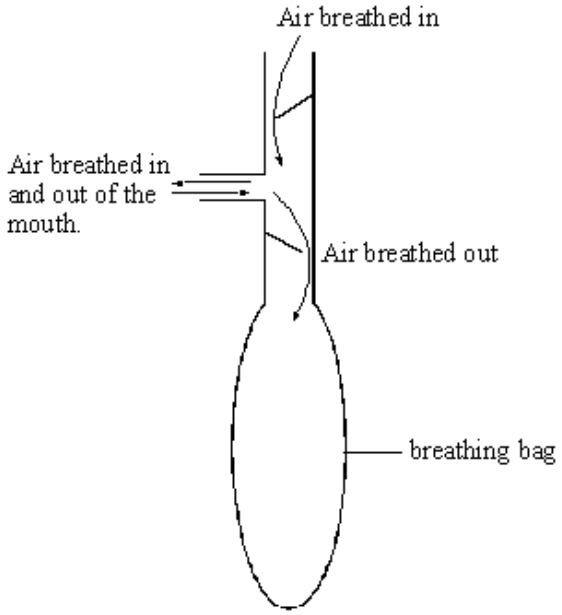
.....

(4)

(Total 7 marks)

Q4. 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.

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)

M1. (a) (i) 19 800

for correct answer ignore working or lack of working
*165 × 120 but no answer / wrong answer = **1** mark (ignore extras)*

2

(ii) any **two** from:

- for respiration
  ignore oxygen debt
- energy released
  allow energy produced
- prevents anaerobic respiration
- prevents build-up of lactic acid

2

(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

2

[6]

M2. (a) respire

1

oxygen / glucose
glucose / oxygen
} each once only

2

blood

1

carbon dioxide / heat
heat / carbon dioxide
} each once only

2

[6]

M3. (a) (before exercise) – 9 to 11 **and** (after exercise) – 12 **or** 13

both *correct*

1

(b) 0.75 to 0.90

ignore working or lack of working

eg. 2.35 – 1.55 ***or*** $\frac{(2.35-1.0)\times 60}{100}$ ***or*** *other suitable figures for* ***1*** *mark*

2

(c) any **four** from:

still need to remove extra carbon dioxide

still need to remove heat / to cool

(some) anaerobic respiration (in exercise)

lactic acid made (in exercise)

oxygen needed to break down lactic acid **or** suitable reference to oxygen debt

lactic acid broken down to CO_2 and water **or** lactic acid changed into glucose

4

[7]

##

(a) oxygen,
carbon dioxide or water (vapour)

for 1 mark each

2

(b) idea of more air per breath/deeper breaths

for 1 mark

1

(c) (i) respiration

for 1 mark

1

(ii) carbon dioxide,
water

for 1 mark each

2

(iii) more energy required,
for increased muscular activity

for 1 mark each

2

[8]