

**(ii)** a source of nitrogen

.....  
.....  
.....  
.....[2]

**(iii)** the air lock.

.....  
.....  
.....  
.....[2]

(d) Fig. 4.2 shows the change in the yeast population and in the alcohol content in the student's fermenter.

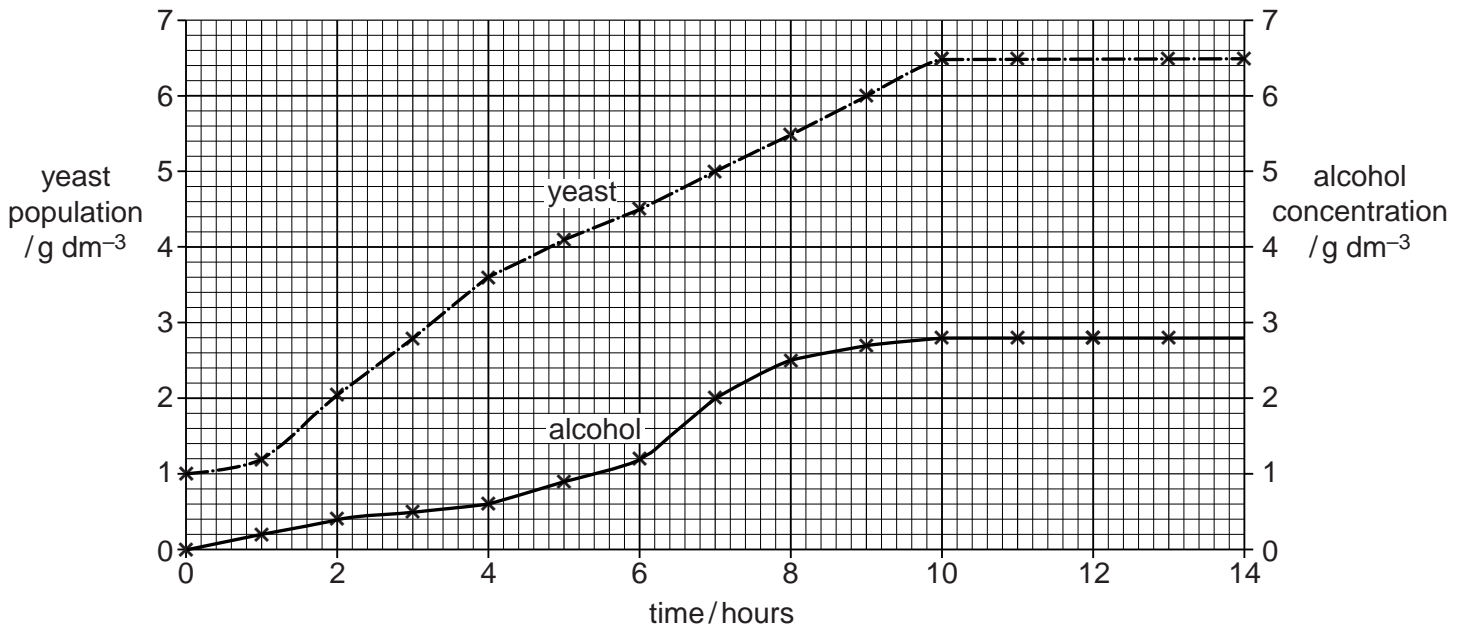


Fig. 4.2

(i) Describe the changes in the population of yeast.

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.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....[3]

(ii) Explain the changes you have described.

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....[3]

(e) Name **two** industrial processes that rely on anaerobic respiration of yeast.

1.....

2.....[2]

**[Total: 17]**

2 (a) Fig. 1.1 shows the human head, neck and thorax.

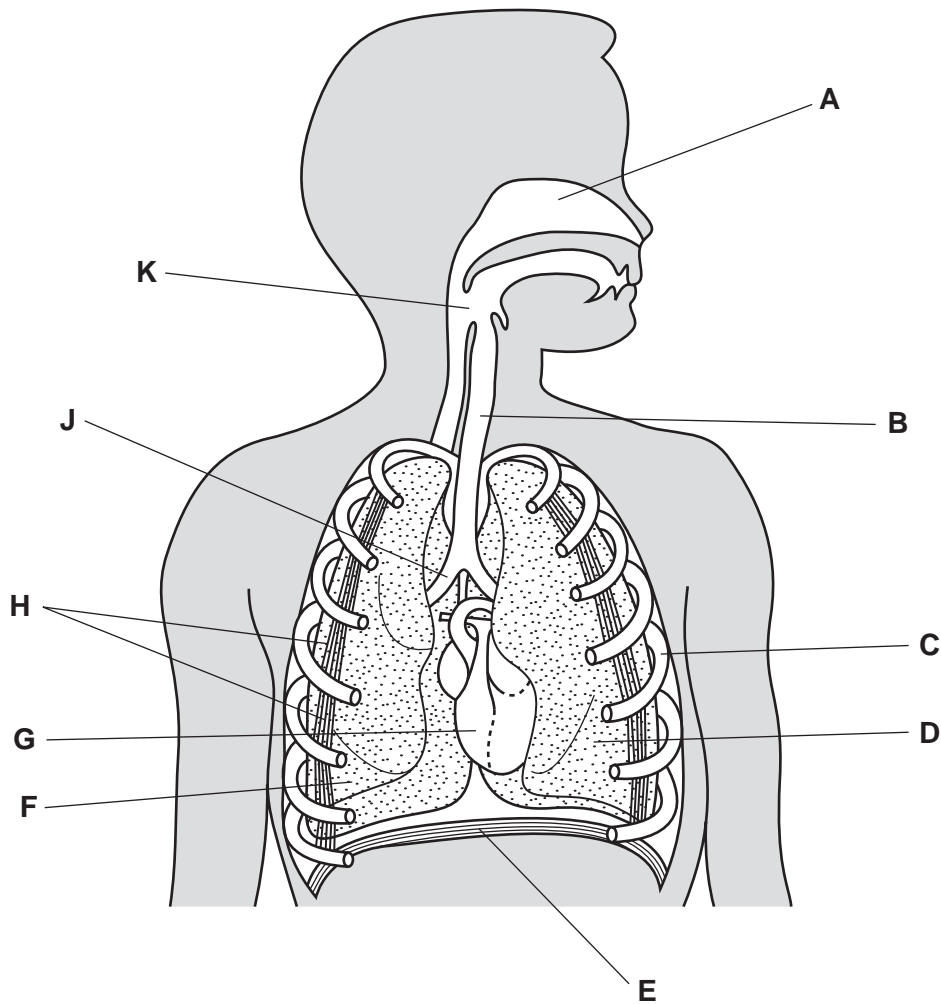


Fig. 1.1

Complete Table 1.1 by writing **one** letter from Fig. 1.1 to identify the named structures.

The first one has been done for you.

Table 1.1

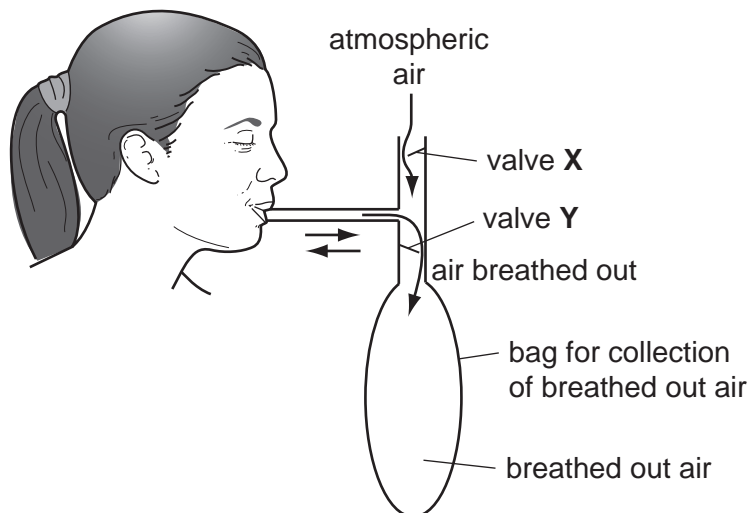
structure	letter from Fig. 1.1
left lung	<b>D</b>
bronchus	
diaphragm	
intercostal muscle	
rib	
trachea	

[5]

(b) In an investigation, a student breathed in and out of the apparatus shown in Fig. 1.2.

Valve **X** opens to allow atmospheric air in while valve **Y** is closed.

When the student breathes out, valve **X** is closed and valve **Y** opens to allow breathed out air into the bag.



**Fig. 1.2**

The student breathed in and out **four times**. The bag was sealed and the volume of air inside the bag was measured.

A sample of air from the bag was analysed for the percentage composition of oxygen, carbon dioxide and nitrogen.

The student then did some vigorous exercise for five minutes. After the exercise, the student repeated the procedure.

The results of the investigation are shown in Table 1.2.

**Table 1.2**

	sample of breathed out air	
	before exercise	after exercise
total volume of air collected in bag / cm <sup>3</sup>	2000	15000
mean volume of air per breath / cm <sup>3</sup>	500	
percentage of oxygen / %	17.2	15.3
percentage of carbon dioxide / %	3.6	5.5
percentage of nitrogen / %	74.9	74.7

- (i) Calculate the mean volume of air per breath after exercise.

Write your answer in Table 1.2.

Show your working.

[1]

- (ii) Suggest **one** way, **not shown** in **Table 1.2**, in which the student's breathing changed after exercise.

.....  
..... [1]

- (iii) The figures in Table 1.2 for the percentage composition of air in each sample do not add up to 100%.

Name **one** other gas that would be present in **both** samples of air.

..... [1]

- (iv) The results for oxygen and carbon dioxide in the samples of breathed out air taken before and after exercise are different.

Describe **and** explain these differences.

.....  
.....  
.....  
.....  
.....  
..... [3]

[Total: 11]

- 3 (a) Yeast cells and human muscle cells can carry out both aerobic and anaerobic respiration.

Complete Table 4.1 by writing the end products of aerobic and anaerobic respiration in these two types of cell.

**Table 4.1**

cell	end products of respiration	
	aerobic	an
yeast	<p>.....</p> <p style="text-align: center;">+</p> <p>.....</p>	<p>.....</p> <p style="text-align: center;">+</p> <p>.....</p>
human muscle cell	<p>.....</p> <p style="text-align: center;">+</p> <p>.....</p>	<p>.....</p>

[4]

- (b) During exercise there are changes to:

- breathing rate;
- ventilation rate;
- oxygen absorption;
- heart rate;
- blood pressure.

The effect of strenuous exercise is shown in Table 4.2.

**Table 4.2**

	before exercise	immediately after exercise
breathing rate / breaths per minute	11	22
ventilation rate (volume of air taken into the lungs per minute) / dm <sup>3</sup> per minute	6	90
oxygen absorption / cm <sup>3</sup> per minute	250	2500
heart rate / beats per minute	65	170
blood pressure / kPa	15	25

Explain why the changes shown in Table 4.2 occur during exercise.

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.....

..... [5]

**[Total: 9]**



4 Niusila Opeloge from Samoa holds a Commonwealth Games record for weightlifting. He can lift 338 kg. Weightlifting is an example of an anaerobic sport as muscles act over a short period of time.

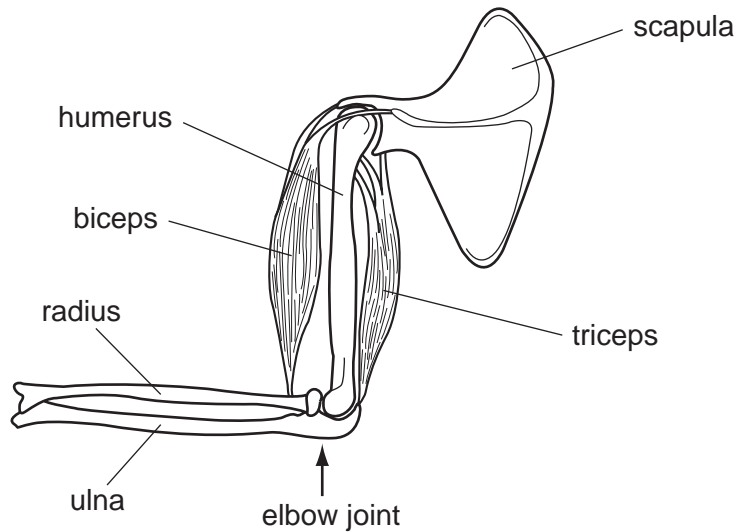
(a) Write a balanced chemical equation for anaerobic respiration in muscle.

..... → .....

[2]

Weightlifting involves contraction of the muscles of the arms.

Fig. 4.1 shows the muscles that move the forearm.



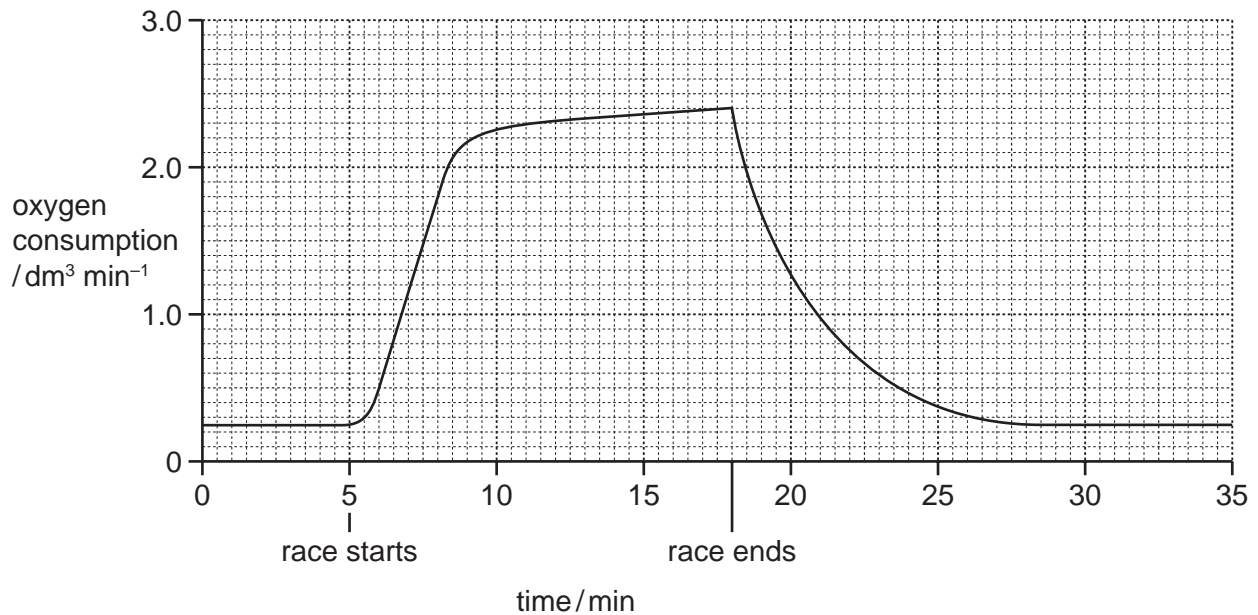
**Fig. 4.1**

(b) Describe how the muscles identified in Fig. 4.1 work to move the forearm up.

.....  
.....  
.....  
..... [2]

Exercise that occurs over a longer period of time than weightlifting often involves aerobic respiration as well as anaerobic respiration.

Fig. 4.2 shows the oxygen consumed by an athlete during and after a 5000 metre race.



**Fig. 4.2**

(c) Describe the athlete's oxygen consumption during **and** after the race as shown in Fig. 4.2.

You will gain credit for using the figures in the graph to support your answer.

during .....

.....

.....

.....

.....

after .....

.....

.....

.....

.....

[4]

