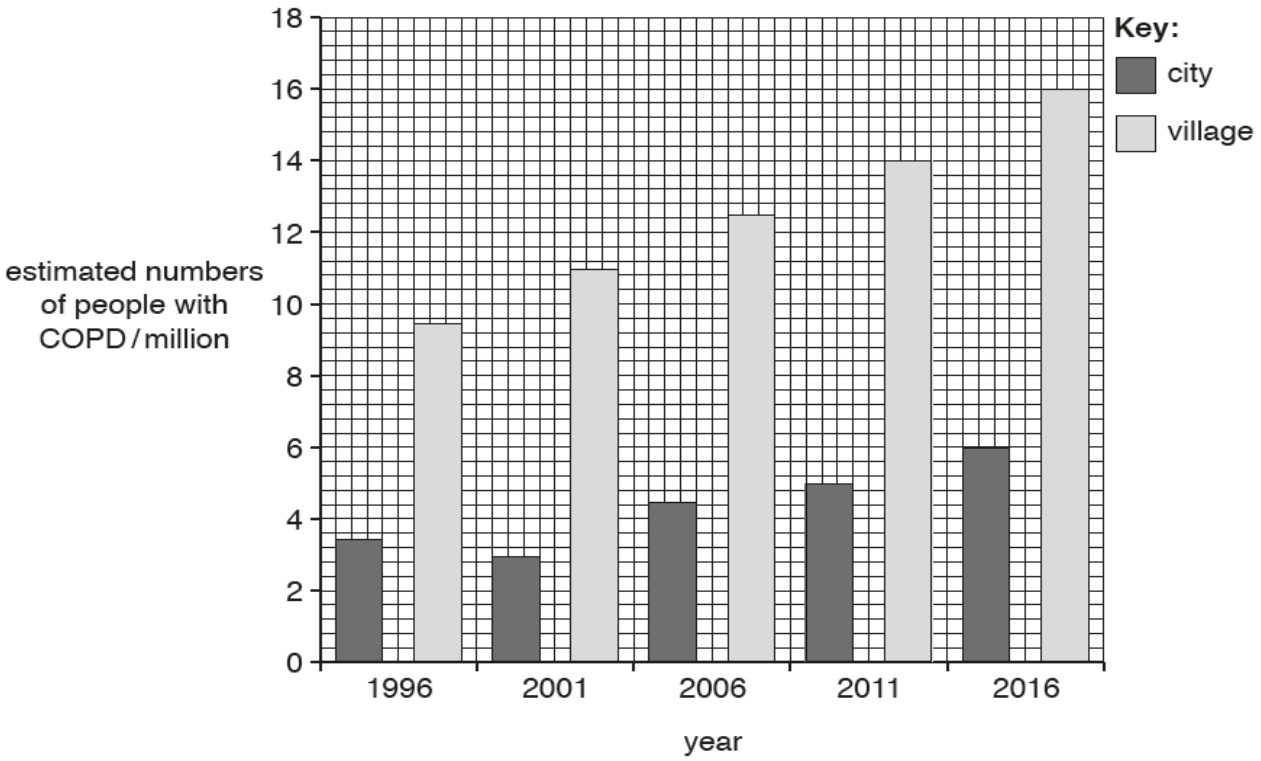
1. A study estimated the number of people with chronic obstructive pulmonary disease (COPD) in India. Data were collected from two groups of people, those who lived in cities and those who lived in villages.




**(a)** Compare the number of people with COPD in cities with the number of people with COPD in villages **and** suggest reasons for the differences.

Use the data in Fig. 2.1 to support your answer.

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**(b) (i)** Explain how the body prevents particles in inspired air from reaching the gas exchange surfaces.

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**(ii)** State **two** ways in which the composition of inspired air differs from the composition of expired air.

1 .....

2 .....

C) Alveoli are well-ventilated to provide efficient gas exchange.

**(i)** State the name of the muscles that cause the ribs to move during ventilation.

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**(ii)** During inspiration the pressure and volume in the thorax changes.

State these changes.

pressure .....

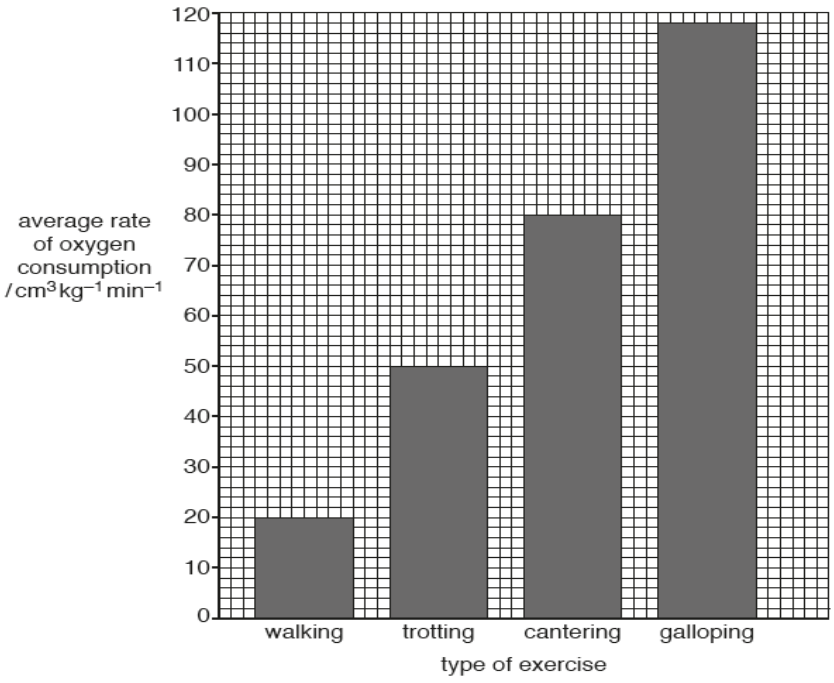
volume .....

2 **(a)** State the balanced chemical equation for aerobic respiration.

.....

B) Researchers in the Czech Republic investigated oxygen consumption in horses. They measured the oxygen consumption of the horses while they were exercising at four different paces: walking, trotting, cantering and galloping.

The results are shown in Fig.



Calculate the percentage increase in the average rate of oxygen consumption as the horses change from walking to trotting.

Show your working.

..... %

C) The researchers also calculated the oxygen debt for each type of exercise.

They found that the horses developed a larger oxygen debt when they exercised by galloping and cantering rather than when they walked.

Explain why the horses developed an oxygen debt when they exercised.

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**(d)** Describe how the horses would recover from an oxygen debt when they stop exercising.

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3A) Fly larvae are immature insects that are often used in experiments on respiration.

Give the balanced chemical equation for aerobic respiration.

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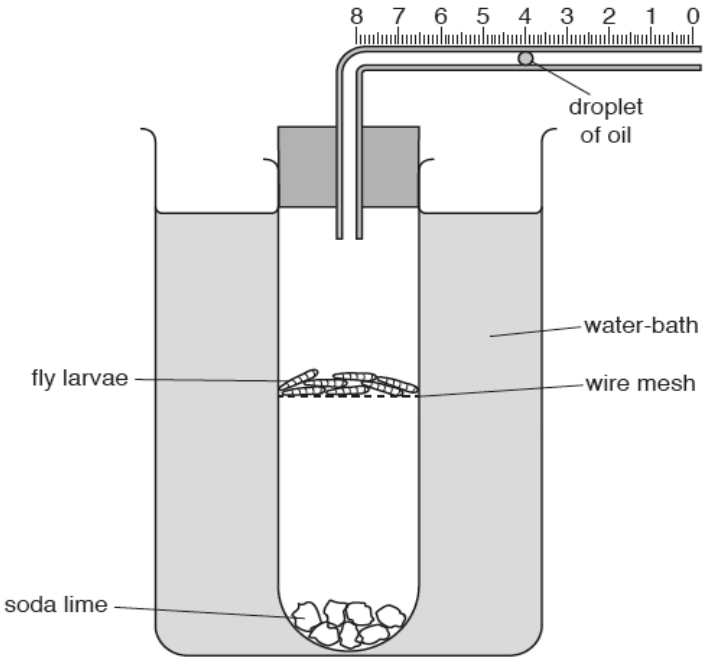
B) A respirometer is shown in Fig. 5.2. It can be used to estimate an organism's rate of respiration.




**(i)** Complete the sentences:

A respirometer can be used to calculate the ..... of oxygen used by the fly larvae by measuring the ..... the droplet of oil moves in one minute. A water-bath is used to ..... the temperature of the apparatus

**(ii)** The soda lime in the respirometer absorbs carbon dioxide.

Explain why this is important in this investigation.

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**(iii)** Fly larvae respire to release energy.

State **two** uses of energy in a fly larva.

1 .....

2 .....

C) A student used a respirometer to investigate the effect of temperature on the rate of respiration of germinating seeds.

Predict the results of this investigation and explain your prediction.

prediction .....
.....
.....

explanation .....
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4) **(a)** State the balanced chemical equation for aerobic respiration.

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**(b)** Students investigated the rate of respiration of crickets (a type of insect) using a carbon dioxide sensor and laptop as shown in Fig.The sensor was fitted inside an airtight glass jar. The apparatus was set up in a room with a constant temperature of 17 °C.

The students found that the concentration of carbon dioxide inside the jar increased by 50 ppm in 120 seconds.

Calculate the rate of carbon dioxide production as ppm per second.

Show your working and express your answer to two significant figures.

..... ppm $s^{-1}$

**(c)** After 10 minutes, the students opened the jar by removing the sensor. They left the jar open for 5 minutes but made sure that the crickets remained in the jar. They then replaced the sensor and took more readings for another 10 minutes.

State **and** explain one reason for opening the jar after 10 minutes.

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**(d)** During the investigation the temperature inside the jar increased. The temperature outside the jar remained constant

Explain why the temperature inside the jar increased.

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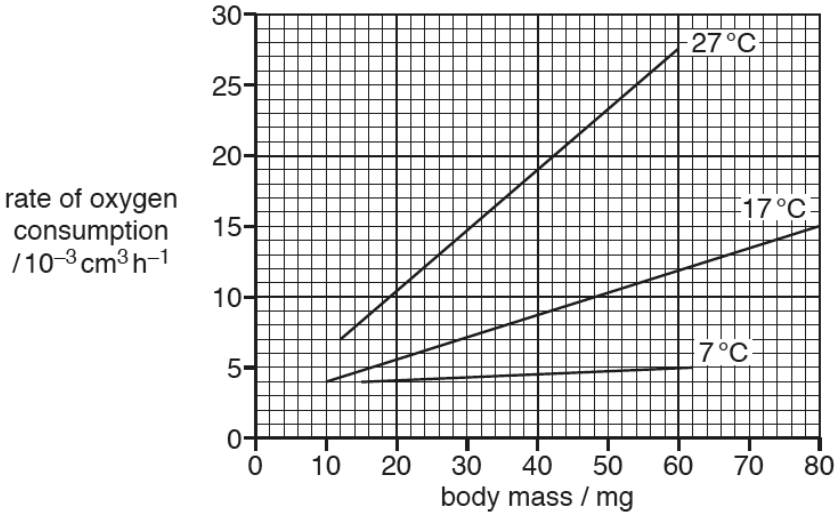
**E)** Researchers in Chile also investigated the rate of respiration in crickets.

They investigated the effect of temperature and body mass on the rate of respiration. They measured the rate of oxygen consumption in crickets with different body masses, at different temperatures.

The researchers' results are shown in Fig.




State **two** conclusions that can be made from the data in Fig. **and** support each conclusion with evidence from the graph.

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5) Alcohol can be made by the microorganism yeast.

State the balanced chemical equation for the production of alcohol by yeast.
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6) The gills are the site of gas exchange.

State **two** features of gas exchange surfaces.

1 .....
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2 .....
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7) Wheat is a crop plant grown to produce flour.

**(a)** Flour is used to make dough for bread.

**(i)** State the name of the organism used to make dough rise.

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**(ii)** State the name of the process that this organism uses to produce the gas that makes dough rise.

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8) Describe how the ventilation of the lungs will change while the athlete exercises.
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9) A group of students planned an investigation to determine the effects of physical activity on breathing rate.

**(a)** Describe how the students could measure their breathing rates.

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**(b)** The students measured their breathing rates before physical activity and every minute for five minutes after cycling around the school field.

Write a hypothesis for their investigation.

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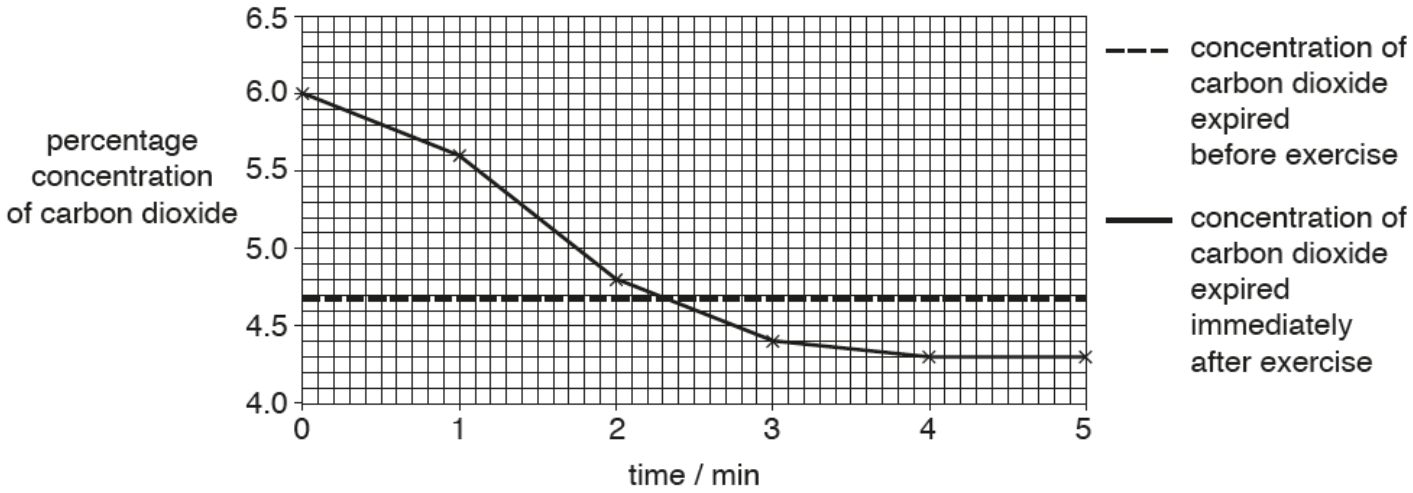
**(c)** Fig. shows a woman on a stationary bicycle. The mask fitted over her nose and mouth measures the composition of the air she breathes out.

Fig. shows the concentration of carbon dioxide in the air expired by the woman in the five minutes after she stopped exercising.

The dashed line on the graph shows the concentration of carbon dioxide in her expired air when she was at rest, before she began to exercise.




Describe **and** explain the results of the investigation shown in Fig.

Use the data in Fig. in your answer.

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10) **(a) Yeast** can respire aerobically and anaerobically.

State the balanced chemical equation for aerobic respiration by yeast.

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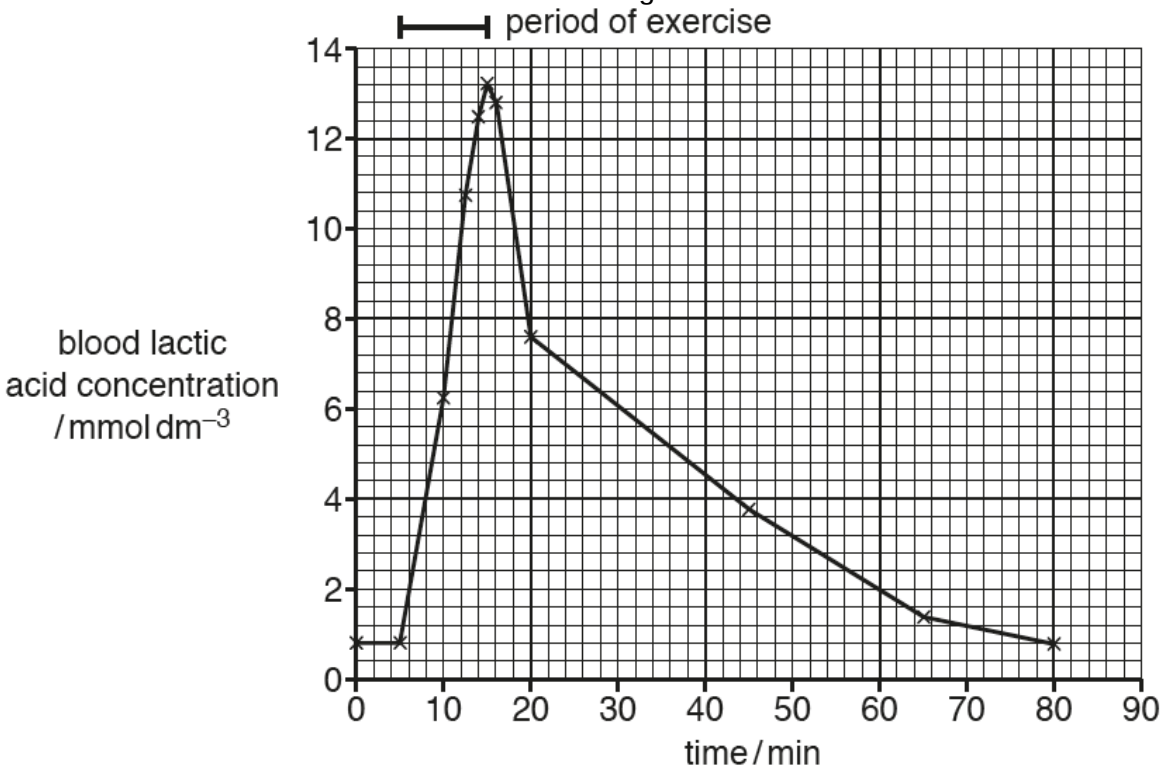
11) The lungs and the kidneys are part of the excretory system of mammals.

State the name of **one** substance that is excreted from the lungs and state where in the body it is produced.

name .....

site of production .....

12A) The results of the tests for lactic acid are shown in Fig




Describe **and** explain the changes in blood lactic acid concentration shown in Fig.

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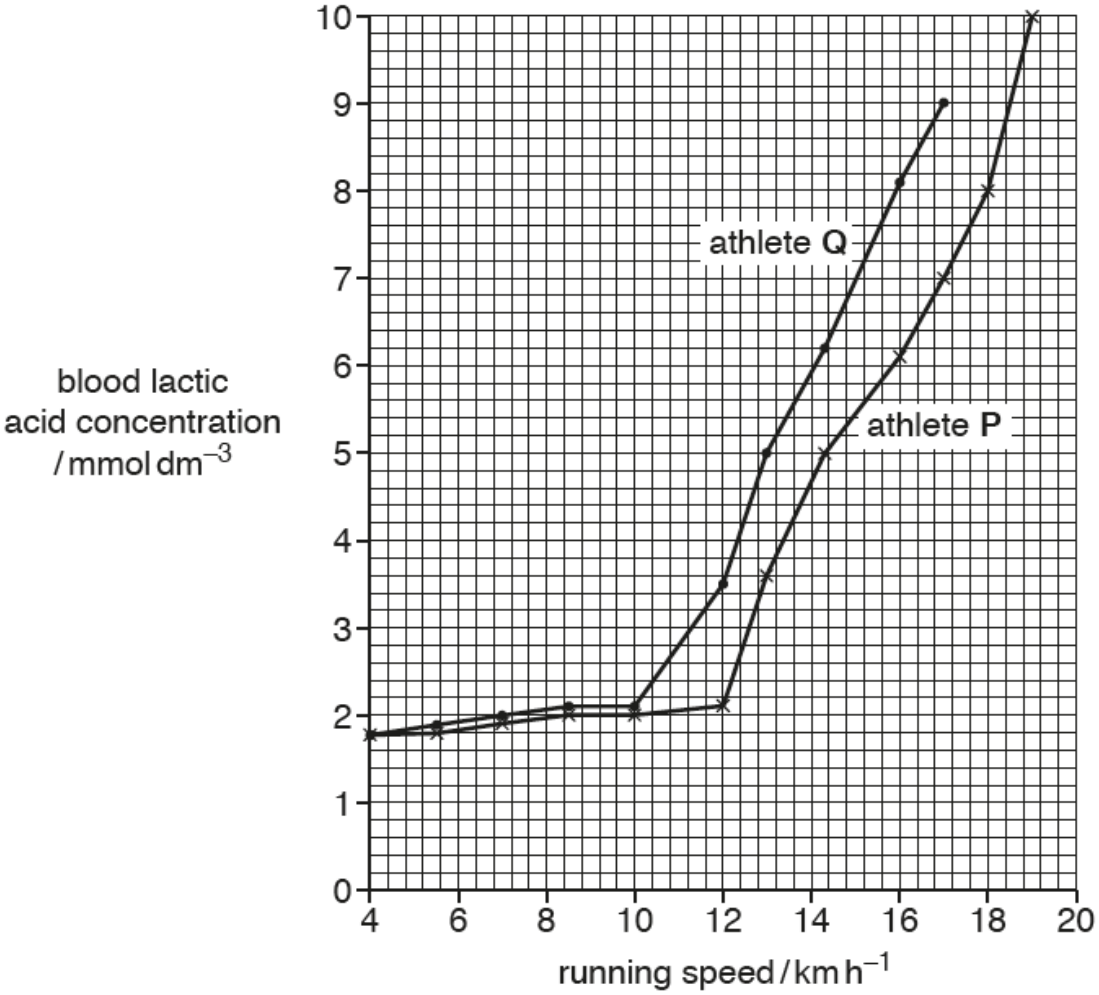
B) The concentration of lactic acid in the blood of two athletes was investigated. One athlete, **P**, had been training and the other, **Q**, was returning to training after an injury.

Blood samples were taken from both athletes during a training session. The results are shown in Fig.




**(i)** The lactic acid threshold is the level of exercise where the lactic acid concentration begins to increase exponentially.

State the lactic acid threshold for athletes **P** and **Q**.

**P** ..... km $h^{-1}$

**Q** ..... km $h^{-1}$

**(ii)** Suggest a reason for the difference in lactic acid threshold of athletes **P** and **Q**.

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**(iii)** Explain the link between physical activity and breathing.

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13) Table shows different specialised cells and the average number of mitochondria each cell contains.

| specialised cell type | average number of mitochondria |
|---|---|
| liver cell | 1000–2000 |
| red blood cell | 0 |
| sperm cell | 25–75 |
| heart muscle cell | 1500 |

Explain the differences between the average numbers of mitochondria in the cells shown in Table
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14a) Yeast is used in bread-making. It respires anaerobically, producing carbon dioxide.

Write the balanced chemical equation for anaerobic respiration of yeast in bread-making.
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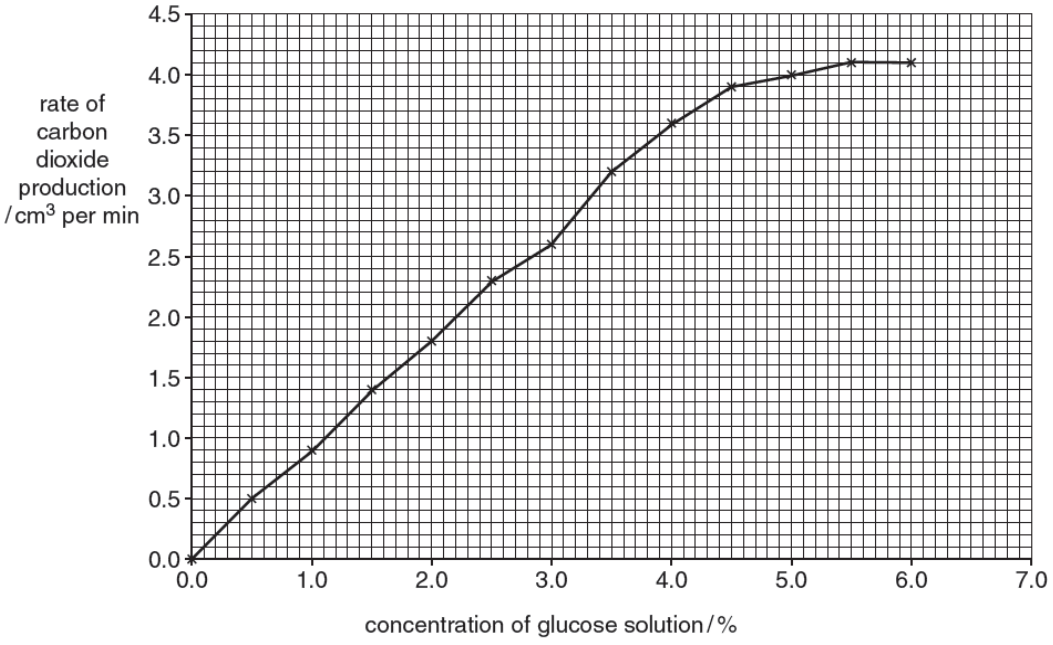
A baker wants to increase the rate of carbon dioxide production in the bread-making process. The baker trialled different concentrations of glucose solution in the bread dough. Fig. shows the results.



**(b) (i) Predict** the rate of carbon dioxide production if the concentration of the glucose solution was 7.0%.

..... $cm^3$per min

**(ii)** The baker carried out the trials at 30 °C.
The trials were repeated at 20 °C.
Draw a line on Fig. 3.1 to show the rate of carbon dioxide production at 20 °C.

**(iii)** The baker carried out another trial at 80 °C. No carbon dioxide was released.

State why no carbon dioxide was produced.

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**(c)** Name **one** other industrial process that uses yeast.

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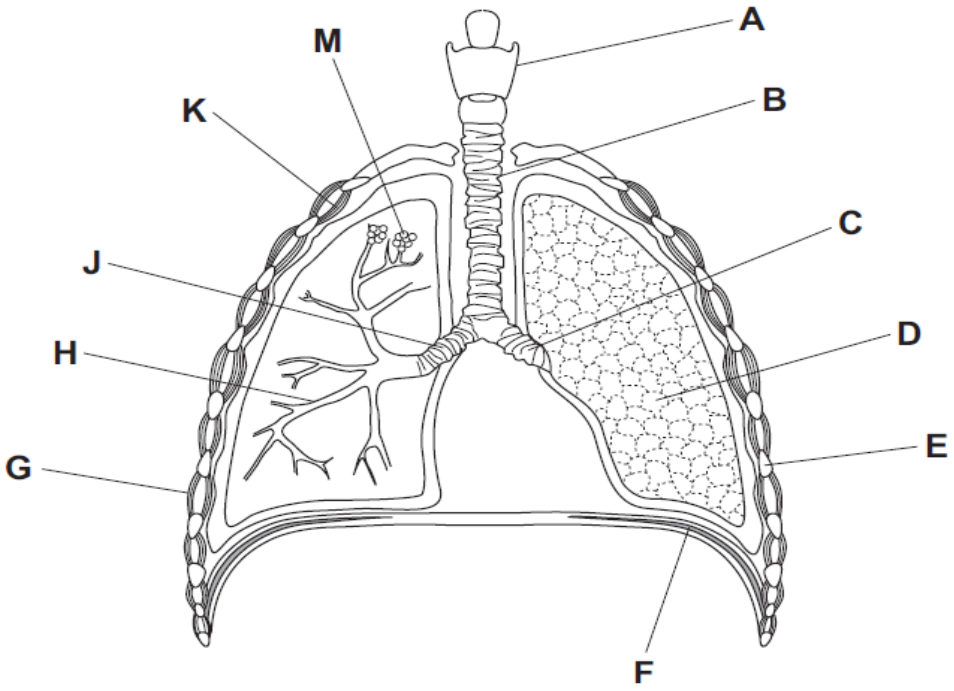
15a) Fig. shows the human gas exchange system. The functions of the parts of the gas exchange system are given in Table.




Complete Table One row has been done for you.

| function | letter on Fig. 1.1 | name |
|---|---|---|
| structure that makes sounds | **A** | larynx |
| bone that provides protection for the lungs | | |
| airway that allows passage of air only into the right lung | | |
| airway that allows passage of air into both lungs | | |
| contracts to increase volume of thorax | | |
| muscle that contracts to lower the ribcage | | |
| site of gas exchange | | |

**(b)** The gas exchange system contains cartilage.

Describe the function of cartilage in the gas exchange system.

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**(c)** Soon after starting physical activity the concentration of carbon dioxide in the blood increases.

**(i)** Name the process inside cells that produces carbon dioxide.

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**(ii)** State the effect on breathing of an increase in carbon dioxide concentration in the blood.

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