

## Chapter 12

# Respiration



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01. 0610\_s18\_qp\_41 Q: 5

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

.....[2]

- (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. 5.1.

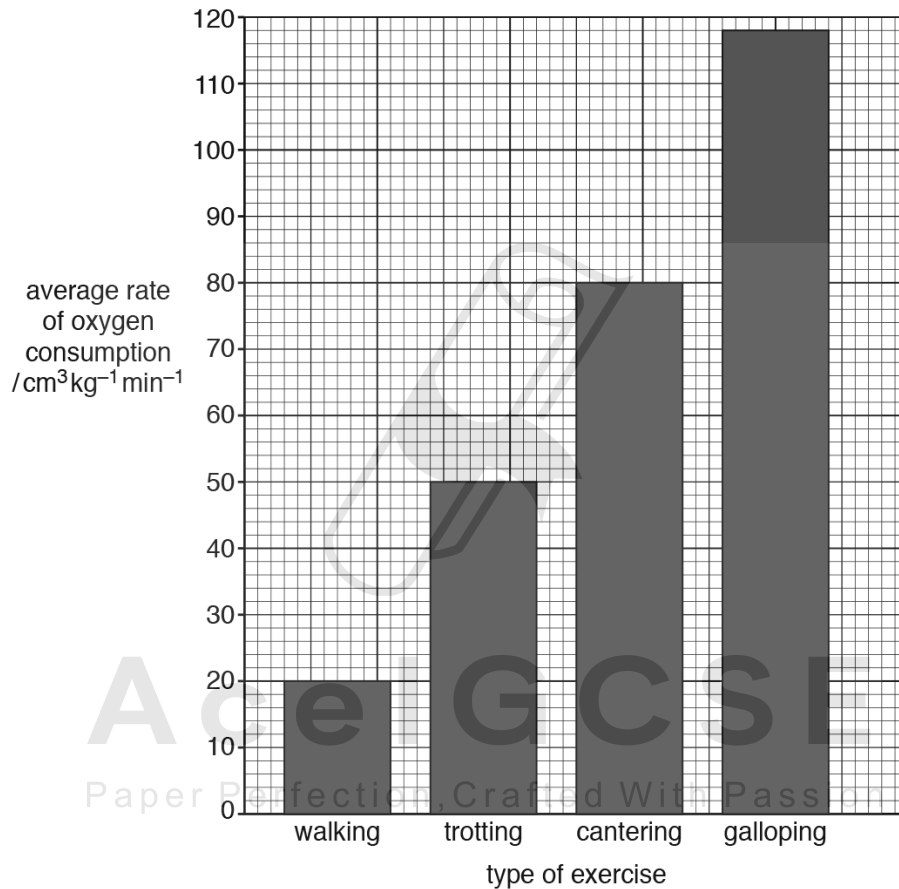


Fig. 5.1



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Fig. 5.1 shows an adult fly, *Chrysomya megacephala*.



Fig. 5.1

(a) State **three** visible features from Fig. 5.1 that could be used to distinguish adult insects from other arthropods.

1 .....

2 .....

3 .....

[3]

(b) Fly larvae are immature insects that are often used in experiments on respiration.

Give the balanced chemical equation for aerobic respiration.

..... [2]

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

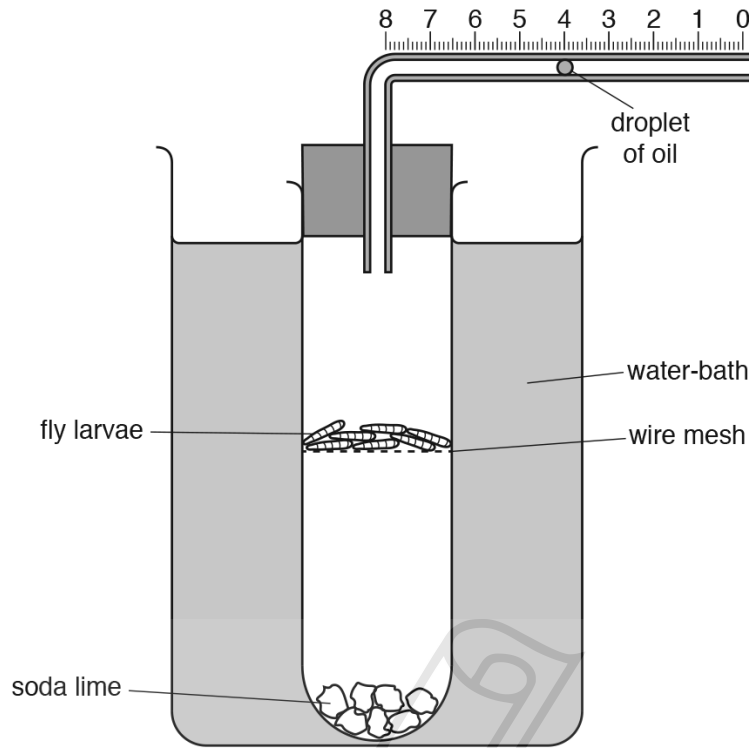


Fig. 5.2

(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.

[3]

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

Explain why this is important in this investigation.

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

(iii) Fly larvae respire to release energy.

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

1 .....  
 2 ..... [2]

- (d) 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 .....

.....

.....

.....

.....

.....

[4]

[Total: 15]

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

.....[2]

(b) Students investigated the rate of respiration of crickets (a type of insect) using a carbon dioxide sensor and laptop as shown in Fig. 5.1. The sensor was fitted inside an airtight glass jar. The apparatus was set up in a room with a constant temperature of 17°C.



Fig. 5.1

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.

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..... ppm s<sup>-1</sup> [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.

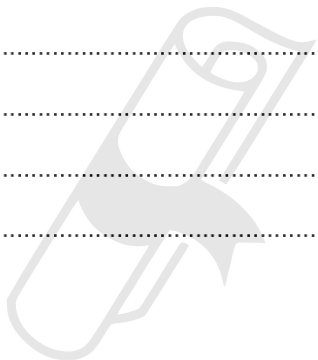
State **and** explain one reason for opening the jar after 10 minutes.

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

- (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.

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



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04. 0610\_s18\_qp\_42 Q: 1

(a) Red pandas, *Ailurus fulgens*, and humans have a similar arrangement of teeth.

Fig. 1.1 shows a section through one tooth of a red panda. Fig. 1.2 shows the side view of the lower jaw of a red panda.

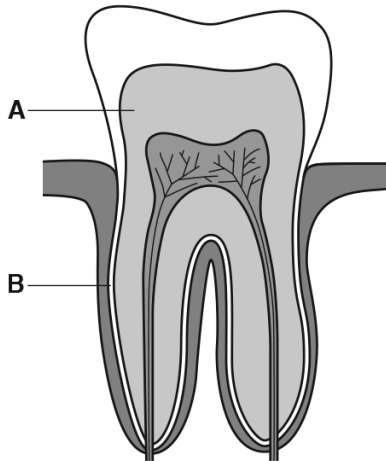


Fig. 1.1

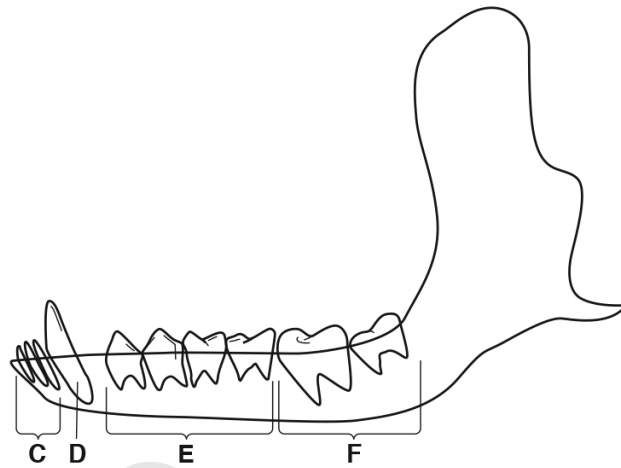


Fig. 1.2

(i) State the names of the structures labelled A to F in Fig. 1.1 and Fig. 1.2.

- A .....
- B .....
- C .....
- D .....
- E .....
- F .....

[3]

(ii) State the type of digestion that breaks down large pieces of food.

..... [1]

(b) Food that sticks to the teeth can be used by bacteria for anaerobic respiration.

This type of respiration releases a substance that can cause tooth decay.

(i) State the type of substance released by the bacteria, during respiration, that causes tooth decay.

..... [1]

(ii) State the names of the **two** parts of a tooth that are dissolved by the substance released by bacterial respiration.

1 .....

2 .....

[2]

(c) The teeth of red pandas do not decay as much as human teeth.

Suggest the component of a human diet that causes teeth to decay as a result of bacterial respiration.

..... [1]

[Total: 8]



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05. 0610\_m17\_qp\_42 Q: 5

(a) (i) Alcohol can be made by the microorganism yeast.

State the balanced chemical equation for the production of alcohol by yeast.

.....[2]

(ii) Name the organ that breaks down alcohol in the human body.

.....[1]

(b) Fig. 5.1 shows a computer model of the enzyme alcohol dehydrogenase, which is the enzyme responsible for breaking down alcohol.

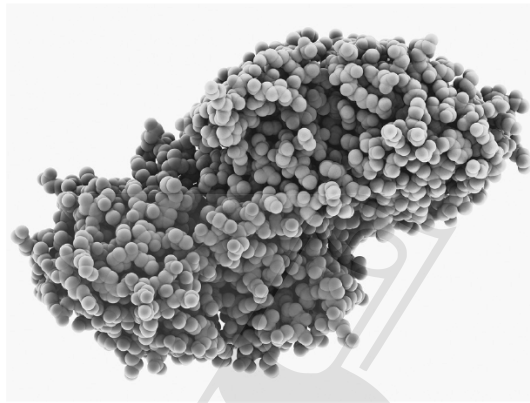


Fig. 5.1

Enzymes have a specific three dimensional shape.

Explain why the shape of an enzyme is important.

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



06. 0610\_w17\_qp\_42 Q: 2

A person who wanted to begin a fitness programme did some vigorous exercise.

A fitness trainer took a drop of blood from the person's finger before, during and after vigorous exercise and tested it for lactic acid.

(a) Explain why it is important that the equipment used for taking blood is clean (sterile).

.....

.....

.....

.....[2]

(b) The results of the tests for lactic acid are shown in Fig. 2.1.

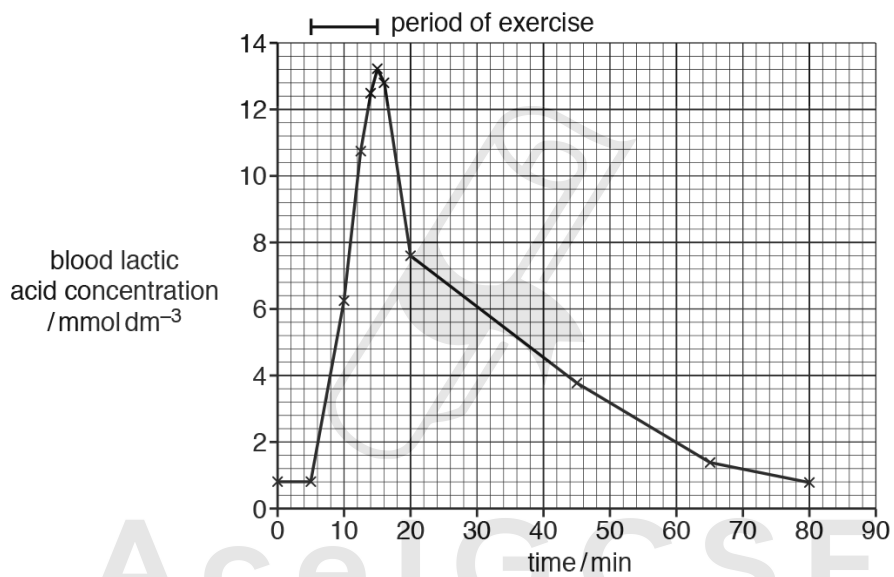


Fig. 2.1

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- (c) 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. 2.2.

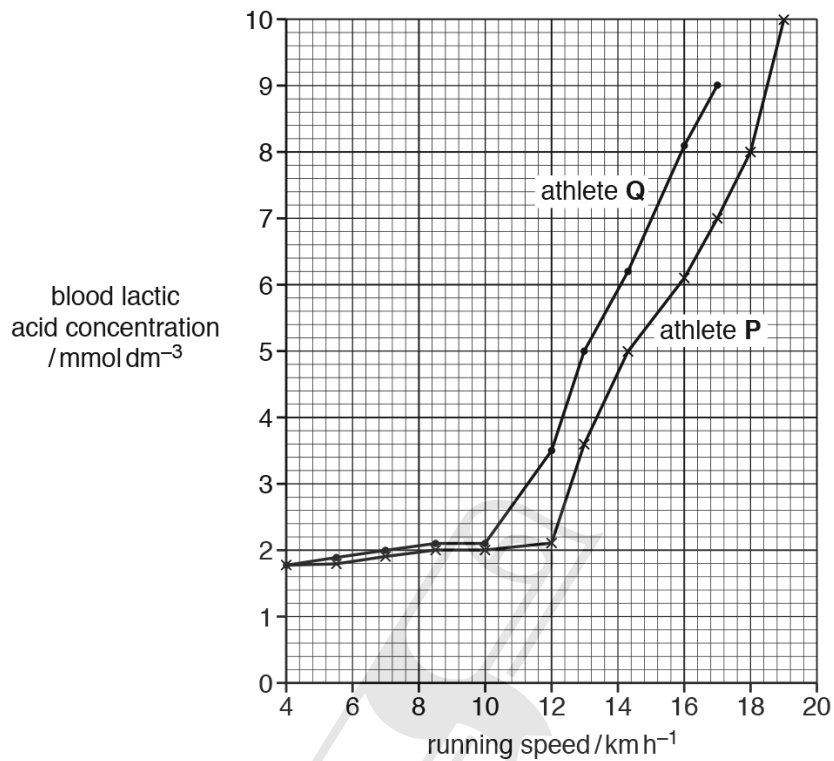


Fig. 2.2

- (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<sup>-1</sup>

**Q** ..... km h<sup>-1</sup>

[1]

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

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



01. 0610\_s18\_MS\_41 Q: 5

	Answer	Mark	Partial Marks
5(a)	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ (+ energy released) ;;	2	one mark for correct symbols one mark for correct balancing
(b)	150(%) ;;	2	one mark for correct working if answer wrong
(c)	demand for, energy / oxygen, increases ; (rate of) respiration increases ; limited supply of oxygen to <u>muscle</u> (tissue) ; <i>idea that</i> heart / pulse / breathing, rate not increased enough ; muscles respire <u>anaerobically</u> ; lactic acid is produced ;	3	
(d)	horses continue to breathe, at high rate / deeper ; continue with a high, heart / pulse, rate ; to provide, enough / AW, oxygen (to 'pay-off' the debt) ; lactic acid, moves / diffuses / AW, (from muscle) into blood ; lactic acid transported to the liver ; (in the liver) lactic acid is, broken down / oxidised / respired (aerobically) ;	4	

02. 0610\_s18\_MS\_42 Q: 5

	Answer	Mark	Partial Marks
(a)	three pairs of legs ; three (named) body segments ; wings ; (pair of) antennae ; <u>compound</u> eyes ;	3	
(b)	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ (+ energy released) ;;	2	one mark for correct symbols one mark for correct balancing
(c)(i)	volume ; distance / length ; control / maintain / regulate / stabilise / keep / constant / sustain ;	3	
(c)(ii)	carbon dioxide will affect, results / volume of gas (in respirometer) / carbon dioxide could kill the larvae ;	1	A to measure (changes in) oxygen only
(c)(iii)	growth / development ; active transport ; protein synthesis ; cell division / mitosis ; passage of nerve impulses ; muscle contraction ;  AVP ; e.g. metabolism / (description of) metamorphosis	2	A movement / breathe / egestion / digestion / excretion
(d)	<i>prediction</i> as temperature increases the respiration rate will increase ; <b>ora</b> and then decrease ;  <i>explanation:</i> there will be an <u>optimum</u> temperature (at a particular temperature) for seed germination ; <i>ref to</i> (respiratory / germination) <u>enzymes</u> ; at high temperatures enzymes denature / described ; at low temperatures not enough (kinetic) energy for, effective collisions / biochemical reactions / respiration / digestion ; <b>ora</b> AVP ;	4	max 3 for explanation  e.g. temperature will also affect the gas pressure in the respirometer

03. 0610\_s18\_MS\_43 Q: 5

	Answer	Mark	Partial Marks
(a)	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ (+ energy released) ;;	2	one mark for correct symbols one mark for correct balancing
(b)	0.42 (ppm s <sup>-1</sup> ) ;	1	
(c)	to allow oxygen to enter the chamber ; keep the crickets respiring <u>aerobically</u> ; to remove carbon dioxide ; to prevent death of crickets ; <i>ref. to ethical treatment of animals ;</i> maintaining similar conditions / resetting, for repeat readings / AW ;	2	
(d)	heat (energy) is released by crickets ; movement / <i>ref. to kinetic energy</i> ; pressure increase ; increased carbon dioxide leading to greenhouse effect ; small closed space ;	2	
(e)	rate of oxygen consumption increases with body mass of crickets (for each temperature) ; any suitable data quote comparing rate at different masses (at same temperature) ; rate of oxygen consumption increases with temperature ; any suitable data quote comparing rate at two temperatures (for the same body mass) ;	4	A respiration for oxygen consumption

04. 0610\_s18\_MS\_42 Q: 1

	Answer	Mark	Partial Marks
(a)(i)	A dentine B cement C incisors D canine(s) E premolars F molars  ;;;	3	6 / 5 correct = 3 marks 3 / 4 = 2 marks 1 / 2 = 1 mark
(a)(ii)	<u>mechanical</u> ;	1	
(b)(i)	acid ;	1	A carbon dioxide
(b)(ii)	enamel ; dentine ;	2	
(c)	(named) sugar ;	1	

05. 0610\_m17\_MS\_42 Q: 5

	Answer	Mark	Partial Marks
(a)(i)	$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$ ;;	2	
(a)(ii)	liver ;	1	
(b)	correct ref to active site ; enzyme must be complementary shape to, substrate / alcohol ; to make enzyme – substrate complex / to allow substrate to bind to enzyme ; ref to only fits one substrate / specific to one substrate ;	3	A 'lock and key'
(c)(i)	increased <u>kinetic</u> energy ; molecules move faster ; increased frequency of collisions ; increased number of successful collisions ;	3	
(c)(ii)	pH ;	1	
(d)(i)	length of DNA ; that codes for a protein ;	2	
(d)(ii)	mRNA passes through ribosomes ; ribosomes assemble amino acids into proteins ; order of amino acids is determined by the sequence of <u>bases</u> in mRNA ; AVP ;	2	

06. 0610\_w17\_MS\_42 Q: 2

	Answer	Mark	Partial Marks
(a)	prevents contamination / transmission, of (named) pathogen / toxin ; prevents, infection / spreading of disease / illness ; ora	2	
(b)	1 low (concentration) of lactic acid in blood at, rest / the start / before ; 2 lactic acid (concentration) increases, steeply / quickly / AW, during exercise ; 3 reaches a peak / increases and decreases ; 4 decreases steeply, then gradually after exercise ; 5 any use of figures ;  <i>explanation</i> 6 oxygen, demand increases / does not reach muscles fast enough / AW ; 7 anaerobic respiration ; 8 provides / releases, energy ;  9 anaerobic respiration produces lactic acid ; 10 lactic acid diffuses from muscles into the blood ; 11 lactic acid is, broken down / respired / oxidised / converted to glucose / AW ; 12 in the liver ; 13 ref. to oxygen debt ;	6	e.g. peak at $13.2 \text{ mmol dm}^{-3}$ at 15 minutes <input type="checkbox"/> 0.2 mmol  A produces ATP R produce / makes, energy'
(c)(i)	P $12 \text{ (km h}^{-1}\text{)}$ and Q $10 \text{ (km h}^{-1}\text{)}$ ;	1	One mark only both must be right
(c)(ii)	idea that trained athlete / P, has a higher level of (aerobic) fitness (than Q) ; difference in, gender / age / height / mass / lung capacity / lung mass / stroke volume / muscle type ; AVP ;	1	A P, is fitter than Q / has trained more than Q  e.g. ref to genetics but not different genes
(c)(iii)	1 increase in demand for energy ; 2 increase in (aerobic) respiration ; 3 increase in demand for oxygen ; 4 increase in carbon dioxide (concentration) ; 5 decrease in pH / increase in acid, in the blood ; 6 detected by the, brain / chemoreceptors ; 7 (brain stimulates) an increase in breathing rate / faster breathing ; 8 (brain stimulates) an increase in depth of breathing / AW ; 9 ref to negative feedback in correct context ;	4	A 'needs' more energy          e.g. rate of breathing remains high until carbon dioxide concentration returns to, normal / set point