WJEC (Eduqas) Biology GCSE Topic 1.3 Cell Metabolism Questions by Topic

1. *(a)* Complete the sentence below. [2]

Enzymes, which are made of ..... , control the rate of

..... reactions in living cells.

(b) Students investigated the activity of the enzyme amylase, at different pH values. They used the same volumes of solutions and the same time at each pH.

Results of investigation

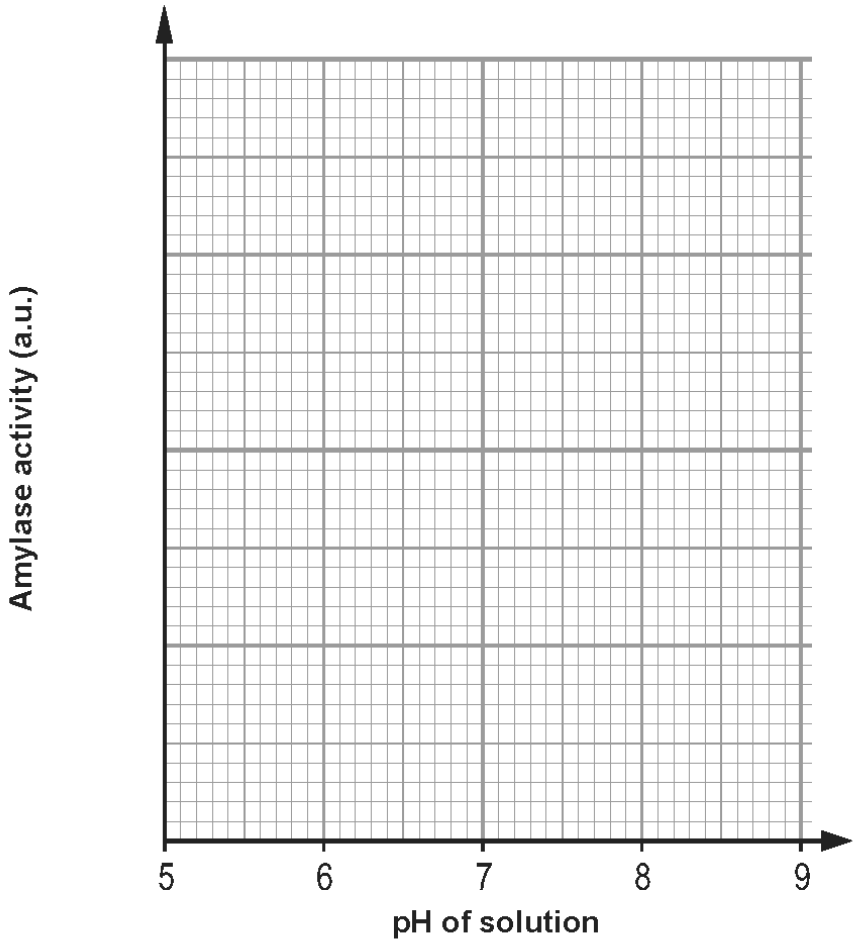
pH of solution	amylase activity (a.u.)
6.0	18
6.5	27
7.0	52
7.5	66
8.0	50
8.5	21

(i) Draw a line graph of the results of the investigation on the grid below by [4]

I. choosing a suitable scale for the amylase activity;

II. plotting the results onto the grid;

III. joining your plots with a ruler.



(ii) I. From the graph opposite, describe in detail the effect of pH on the activity of amylase. [2]

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(iii) The students did not keep the temperature constant during their investigation. Why did this prevent their investigation from being a fair test? [1]

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2. *(a)* Complete the following sentences about enzymes using some of the words from the list below. [3]

digestion **photosynthesis** **diffusion** **respiration** **osmosis**

Some enzymes break down large molecules into small molecules, for example during ..... and ..... .

Other enzymes build up large molecules from small molecules, for example during ..... .

3.

(a) Why do we need to digest large food molecules? [1]

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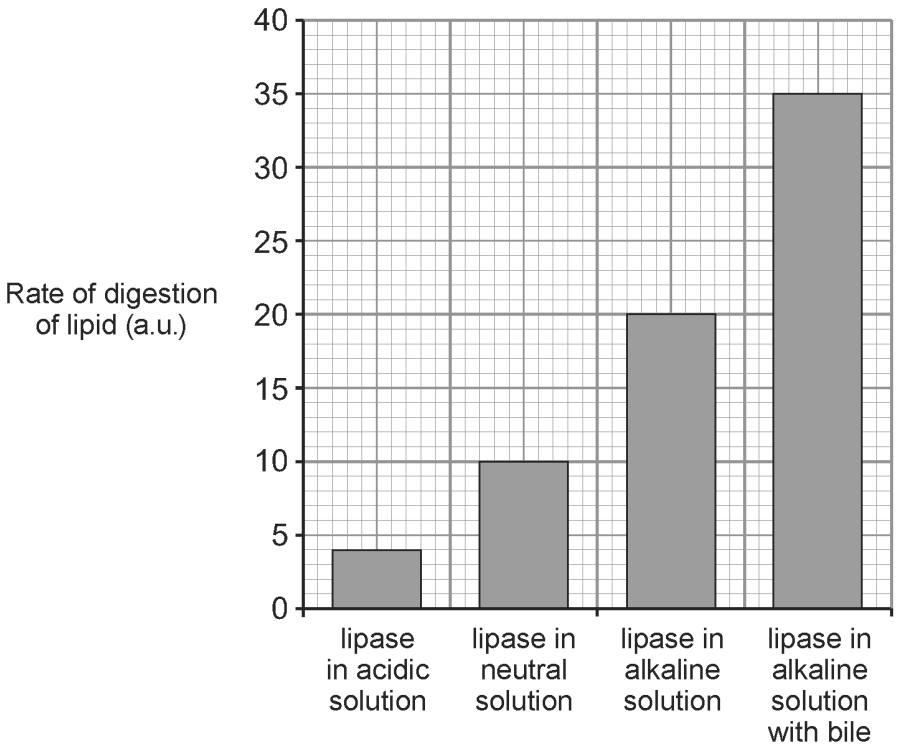
(b) The graph below shows the rate of digestion of lipids by lipase under different conditions.



(i) Describe the effect of pH on the rate of digestion of the lipids. [1]

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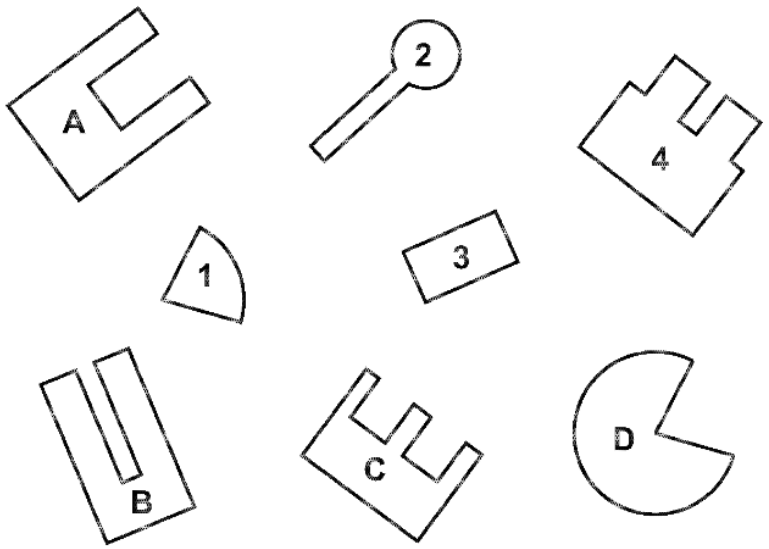
4. *(a)* Use some of the following words to complete the table about enzymes. [3]

fatty acids **lipids** **amino acids** **glucose** **glycerol**

Enzyme	Substrate	Products
protease	protein	.....
lipase	.....	..... and .....

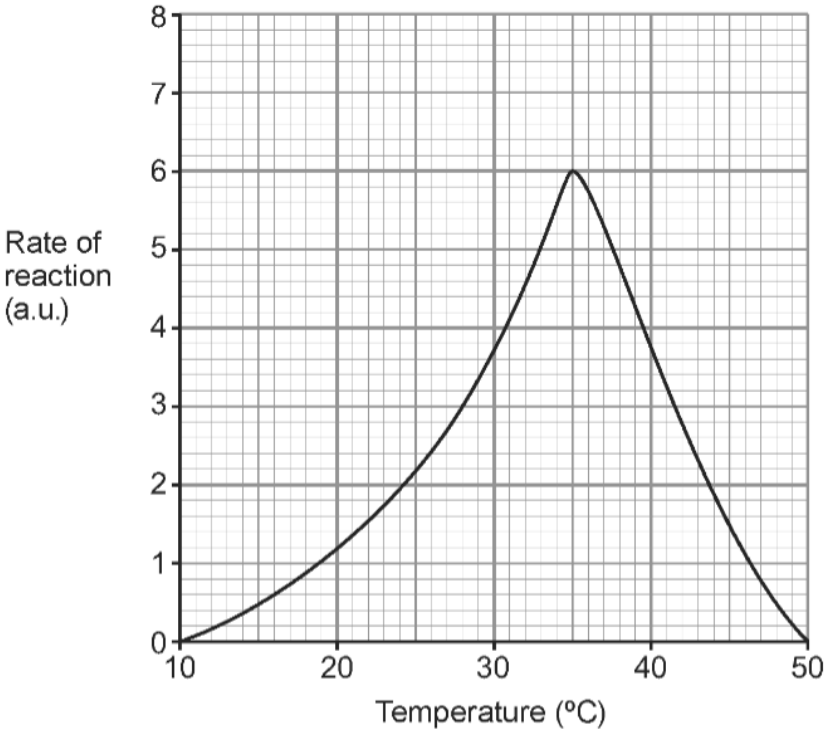
(b) The diagram shows four enzymes **A – D** and four substrates **1 – 4**.



Use your knowledge of the lock and key theory to complete the table below by matching each enzyme to its substrate. [1]

Enzyme	Substrate
A	.....
B	.....
C	.....
D	.....

(c) The graph shows the effect of temperature on the rate of an enzyme controlled reaction between 10 °C and 50 °C.



(i) From the graph, describe the effect of temperature on the rate of the reaction between 10 °C and 50 °C. [3]

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(ii) Most enzymes are denatured by boiling.
Use your answer to part *(b)* to help explain why a denatured enzyme can no longer work. [2]

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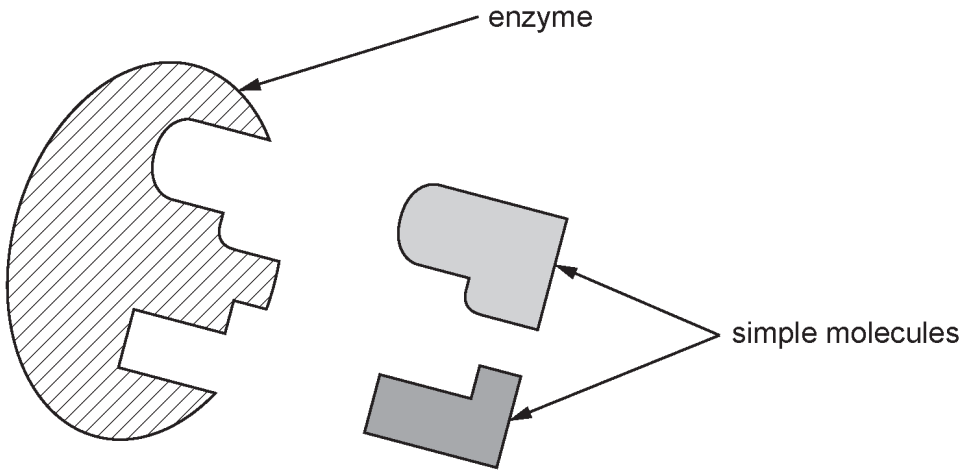
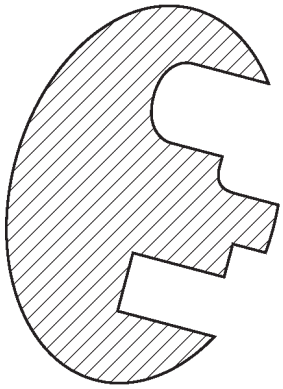
(a) (i) The diagram shows an enzyme which builds up complex molecules from simple molecules.



Complete the diagram below to show the next stage in the reaction between this enzyme and the two simple molecules shown above. [2]



(ii) What name is given to this **model** of enzyme action?

[1]

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(iii) Explain how boiling would affect the action of the enzyme shown in the diagrams above. [2]

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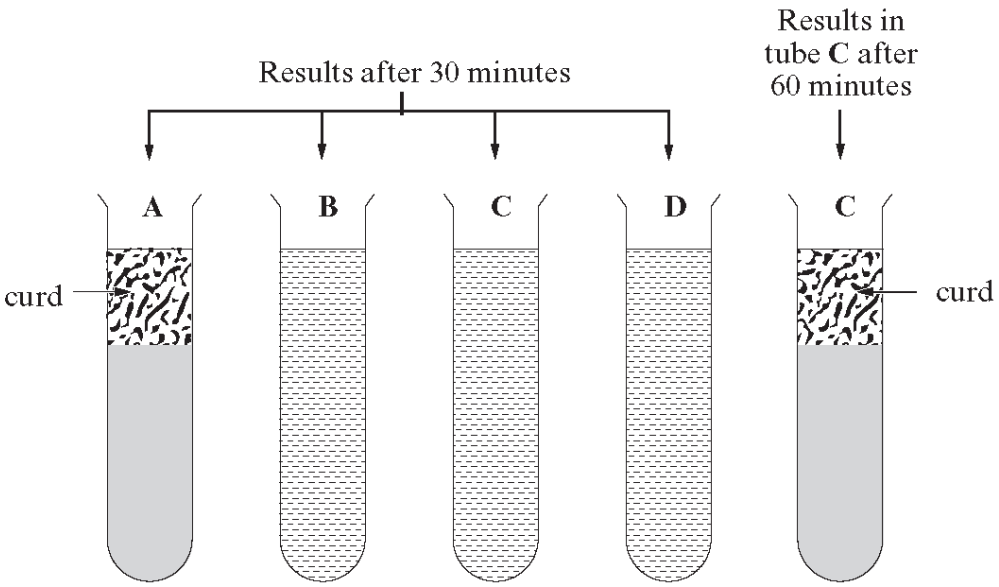
6. Rennilase is an enzyme which acts on milk during cheese making. It turns milk protein into solid milk curd.
An experiment using rennilase was set up as shown by the table below.

Tube	A	B	C	D
Contents of test tube at start	rennilase	rennilase	rennilase	boiled, cooled rennilase
	milk	milk	milk	milk
pH	4.5	9	4.5	4.5
Temperature (°C)	30	30	15	30



(a) (i) State the effect of pH on the action of rennilase. [1]

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(ii) Explain why no curd was produced in tube **D**. [1]

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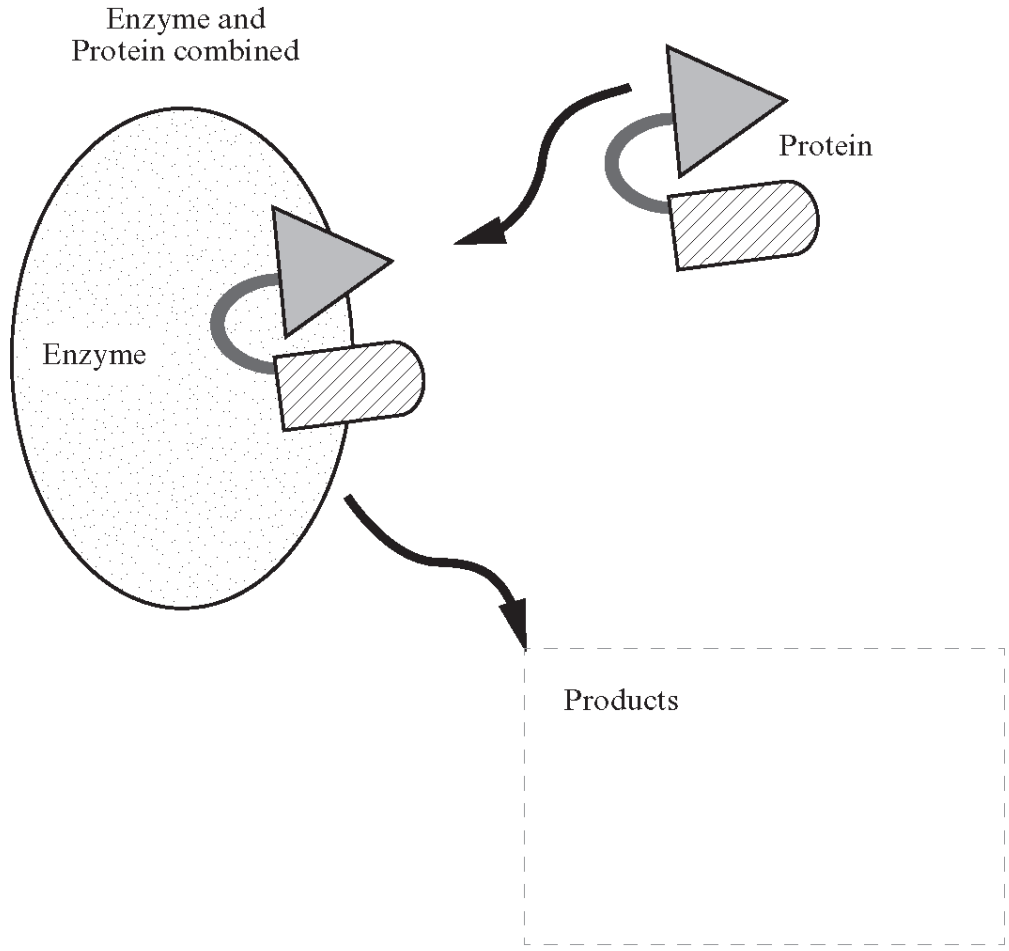
(b) The diagram below shows a model of an enzyme reacting with a protein molecule.

(i) In the box below, sketch the products that would result from this enzyme reaction. [1]



(ii) State the name given to this model of enzyme action. [1]

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7. Write an account of the similarities and differences between aerobic and anaerobic respiration in muscle cells. In your account, explain why aerobic respiration is more efficient than anaerobic respiration. [6 QWC]

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8. *(a)* Complete the word equation below which shows respiration, the process which releases energy in living cells. [1]

glucose + ... ⟶ ..... + water

(b) Some students investigated the release of energy during respiration in living peas. They used the apparatus shown in the diagram below and measured the temperature over a

9. The following word equations show the two types of cell respiration which occur in humans.

Equation 1

Glucose + Oxygen ⟶ Carbon dioxide + Water + ATP

Equation 2

Glucose ⟶ Lactic acid + ATP

Name each of the types of cell respiration shown above and write an account explaining when each occurs in the human body. Include any advantages or disadvantages of each type of respiration. [6 QER]

10.

(a) The table shows a comparison for two athletes, Tomos and Jeremy, who ran in races of different distances.

Athlete	Distance of race (m)	Oxygen needed in the race (dm^3)	Oxygen entering blood in the race (dm^3)
Tomos	100	10	0.5
Jeremy	10 000	150	134.0

(i) The difference between the oxygen needed and the oxygen actually entering the blood during the race is the oxygen debt.
Calculate the oxygen debt for [1]

Tomos ..... dm^3

Jeremy ..... dm^3

(ii) When the race was over, both athletes continued to breathe more rapidly and more deeply than normal for some time. Give the reason for this. [1]

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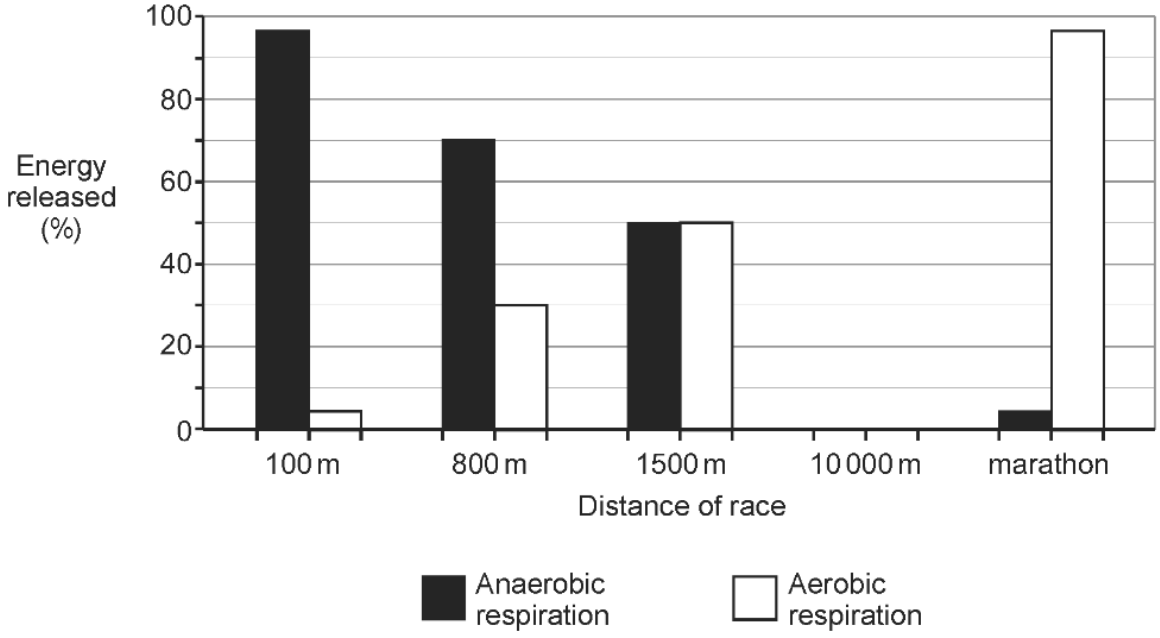
(b) The bar chart shows the percentage of energy released by aerobic and anaerobic respiration for athletes running different distances.



(i) What can be concluded from the data shown in the table and the bar chart for the athlete running 100 m? [1]

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(c) Write the word equations to represent:

(i) Aerobic respiration in human muscle tissue; [1]

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(ii) Anaerobic respiration in human muscle tissue. [1]

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(d) Why is aerobic respiration more efficient than anaerobic respiration? [1]

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11. An investigation compared the composition of inspired and expired air. This is shown in the table below.

Gas	% Concentration of air	
	inspired	expired
oxygen	20.9	16.0
carbon dioxide	0.04	4.0
water vapour	variable	variable
nitrogen	78.1	78.1

(a) (i) Calculate the difference in the % concentration of oxygen in the expired air and the inspired air. [1]

difference = ... %

(ii) State the process in cells that uses oxygen and glucose to release energy. [1]

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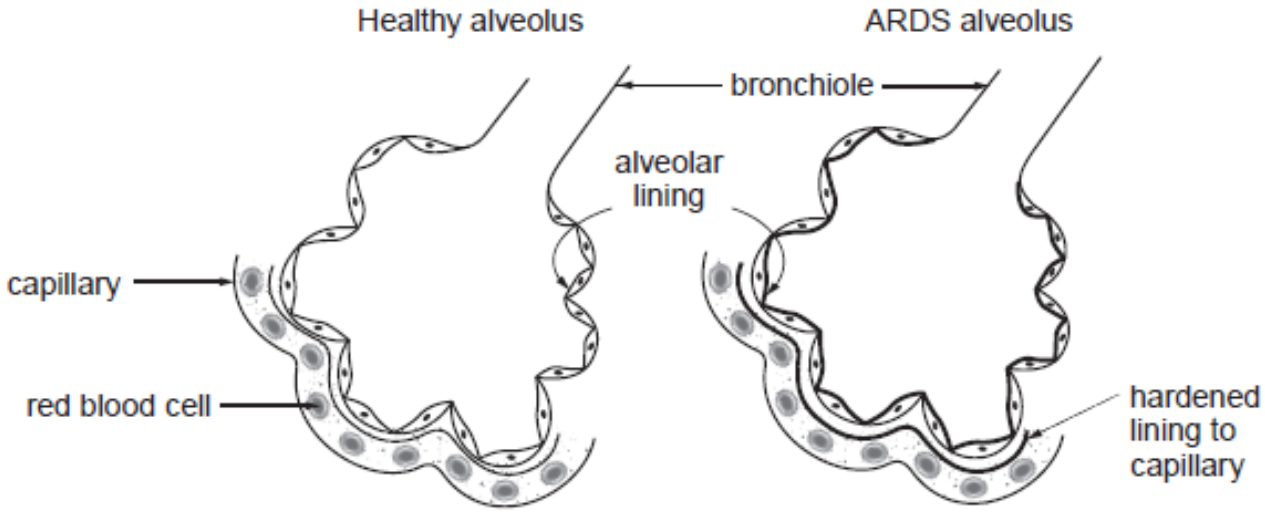
(b) People with a disease called ARDS (Acute Respiratory Distress Syndrome) have difficulty getting enough oxygen.

The diagrams show a healthy alveolus and an alveolus from someone with ARDS.



12. The word equation for aerobic respiration is shown below.

glucose + oxygen ⟶ carbon dioxide + water + ATP

(a) In the space below state the word equation for anaerobic respiration in human cells. [1]

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(b) Explain why anaerobic respiration is less efficient than aerobic respiration. [2]

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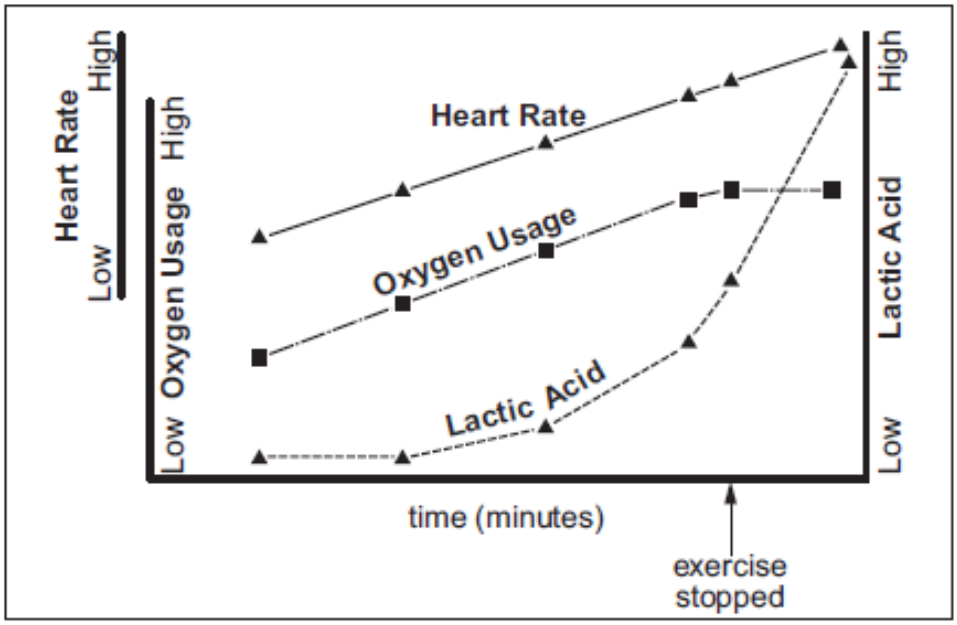
(c) An Olympic athlete exercised on a treadmill. During the exercise her blood oxygen and lactic acid levels were continuously monitored as was her heart rate.
The athlete's fitness coach knew the maximum intensity of exercise she could perform (100%). The athlete increased the intensity of exercise until she reached the maximum intensity of exercise she could perform (100%). She then stopped the exercise but her heart rate and blood levels continued to be monitored.
The graph below appeared on a computer screen.



(i) Explain why, even after exercise stops, the athlete continues to take in and use large volumes of oxygen. [2]

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13. Tom jogged for twenty minutes. The table below shows data about the concentration of lactic acid in his blood during this period of exercise.

time from start (min)	concentration of lactic acid in blood (mg/100 cm^3)
0	4
2	15
4	29
6	44
8	42
10	39
12	30
14	22
16	20
18	18
20	16

Use the data given and your knowledge to answer the questions below.

(a) (i) How many minutes after the start of the exercise was the highest oxygen debt recorded? [1]

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(ii) What type of respiration results in oxygen debt? [1]

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(iii) When would Tom be releasing most energy per glucose molecule? Explain your answer. [2]

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(b) Which type of cell would be producing lactic acid? [1]

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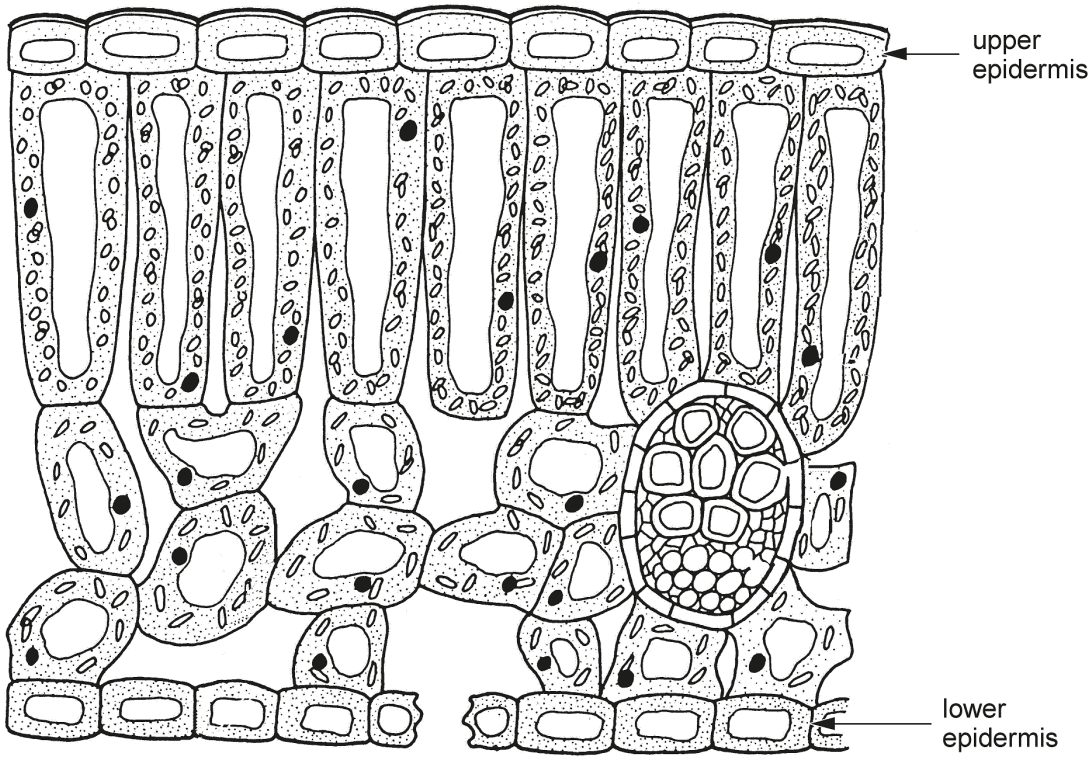
14.

(a) The diagram below shows a leaf in section.



(c) (i) Ethanol can be made by reacting sugar with yeast.
State the name of the reaction between sugar and yeast that produces ethanol. [1]

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(ii) Ethanol is a biofuel. The area of farmland used only to grow crops for the production

15. The table below shows the concentration of lactic acid in the blood of two athletes, Anjum and Tudor, before and after vigorous exercise that lasted 10 minutes.

The concentration of lactic acid was measured at 10 minute intervals after the exercise for the next 50 minutes.

	lactic acid concentration ($mg/100cm^3$)	
time (min)	Anjum	Tudor
0	20	20
10	80	90
20	78	90
30	60	80
40	50	75
50	38	60
60	25	50

(a) Use the data to give reasons why Anjum appears to be fitter than Tudor. [2]

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(b) Give a reason why a marathon runner relies almost totally on aerobic respiration and produces very little lactic acid. [1]

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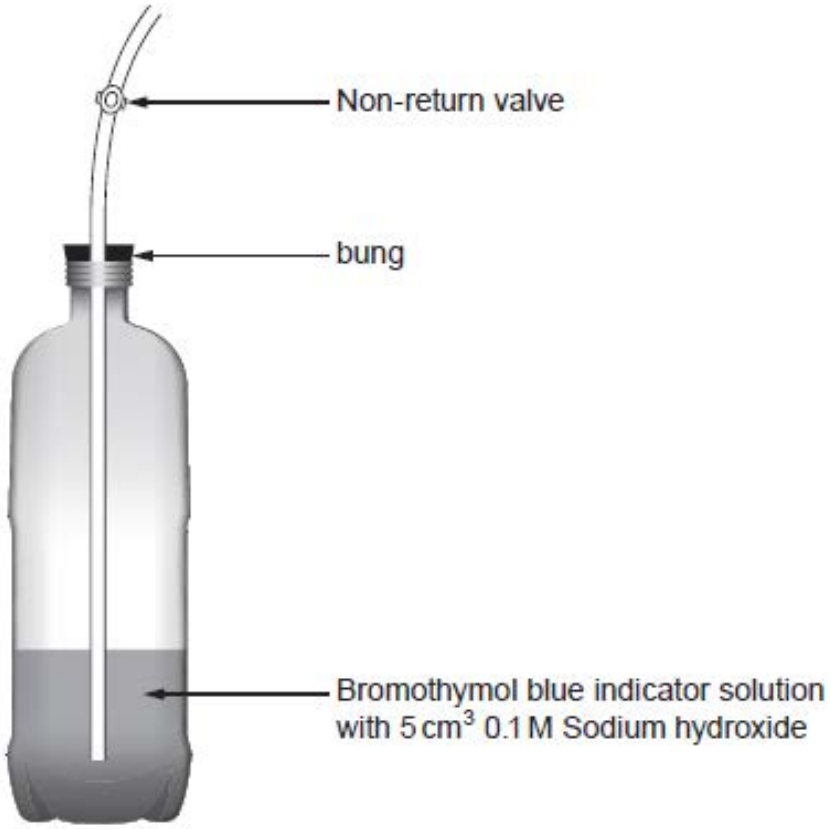
16. A respirometer is a device used to measure the rate of respiration of a living organism by measuring its rate of exchange of oxygen and/or carbon dioxide. A simple respirometer used in a school laboratory is shown below. It can be used to estimate the volume of carbon dioxide in exhaled air.



Fact file

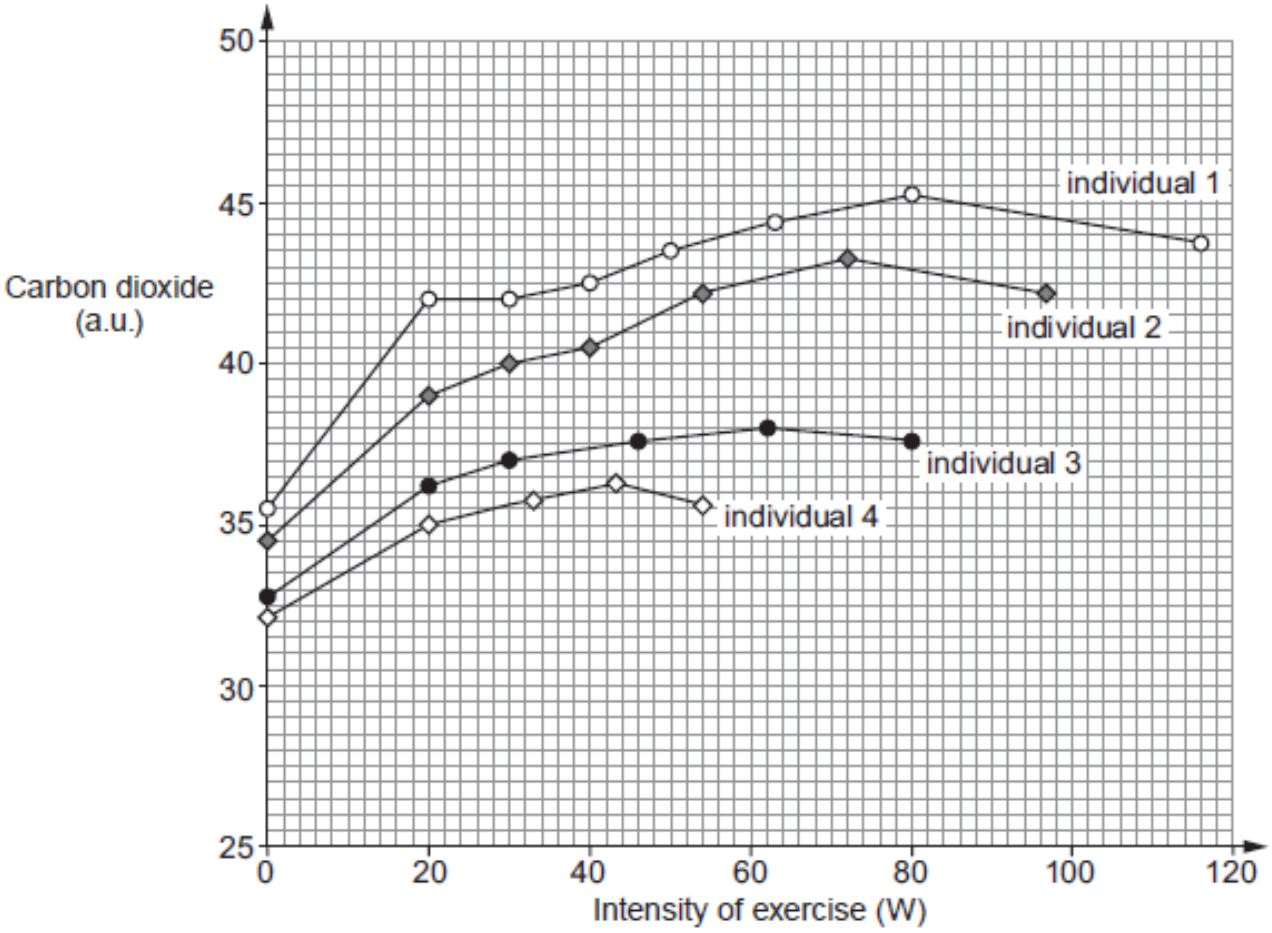
- Bromothymol blue indicator is green when neutral and blue when alkali.
- 5.6 cm^3 of carbon dioxide will neutralise the sodium hydroxide in the respirometer.

The following equation can be used to calculate the volume of carbon dioxide produced per minute.

Volume of carbon dioxide per minute = breathing rate × volume of carbon dioxide in one breath
(cm^3/minute) (breaths/minute) (cm^3/breath)

(b) A group of scientists monitored the proportion of carbon dioxide expired in 4 individuals. The individuals were tested on an exercise bike. They were allowed to rest for 4 minutes, and then exercised at an intensity of 20 watts for 4 minutes. After this time the intensity was increased 1 watt every 6 seconds. Individuals stopped exercising when they suffered cramp in their leg muscles. A gas analyser was used to get an accurate measurement of the expired carbon dioxide level per breath.

The results of the investigation are shown below.



(i) Explain the increase in carbon dioxide levels between an intensity of exercise 0 W and 20 W for all the individuals. [2]

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(ii) The decrease in carbon dioxide levels for all individuals at a higher intensity of exercise was linked to cramp in the muscles. Suggest an explanation for this. [2]

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(c) State why sports scientists working with athletes would measure oxygen consumption as well as carbon dioxide production. [1]

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17. *(a)* (i) During digestion in the human body, large food molecules are broken down. Draw lines joining the large food molecules to the smaller molecules into which they are broken down. [2]

Large food molecules	Smaller molecules
protein	glucose
starch	fatty acids and glycerol
fats	amino acids

(ii) Why is it necessary for these large food molecules to be broken down? [1]

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(iii) State the function of carbohydrate foods in the human body. [1]

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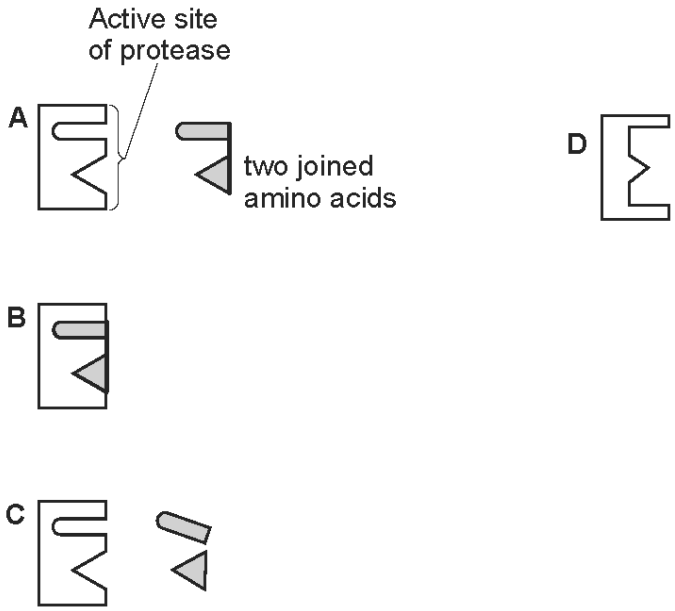
18. Diagrams **A** - **C** illustrate the 'lock and key' theory of enzyme action. It shows how a protease is able to catalyse the separation of two joined amino acids. Diagram **D** shows the protease after it has been denatured.

The "lock and key" theory of enzyme action



(b) Explain why the denatured protease **D**, is unable to catalyse the separation of the two amino acids. [2]

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(c) State **two** factors which affect the rate of enzyme controlled reactions. [2]

I. .....

II. .....

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