

1(a). Cells contain many different organelles, one of them is mitochondria.

What is the function of the mitochondria in the cell?

Put a tick (✓) in the correct box.

Controls entry and exit of substances into the cell

Is responsible for photosynthesis

Makes ATP

Stores the genetic information

[1]

(b). Mitochondria contain enzymes.

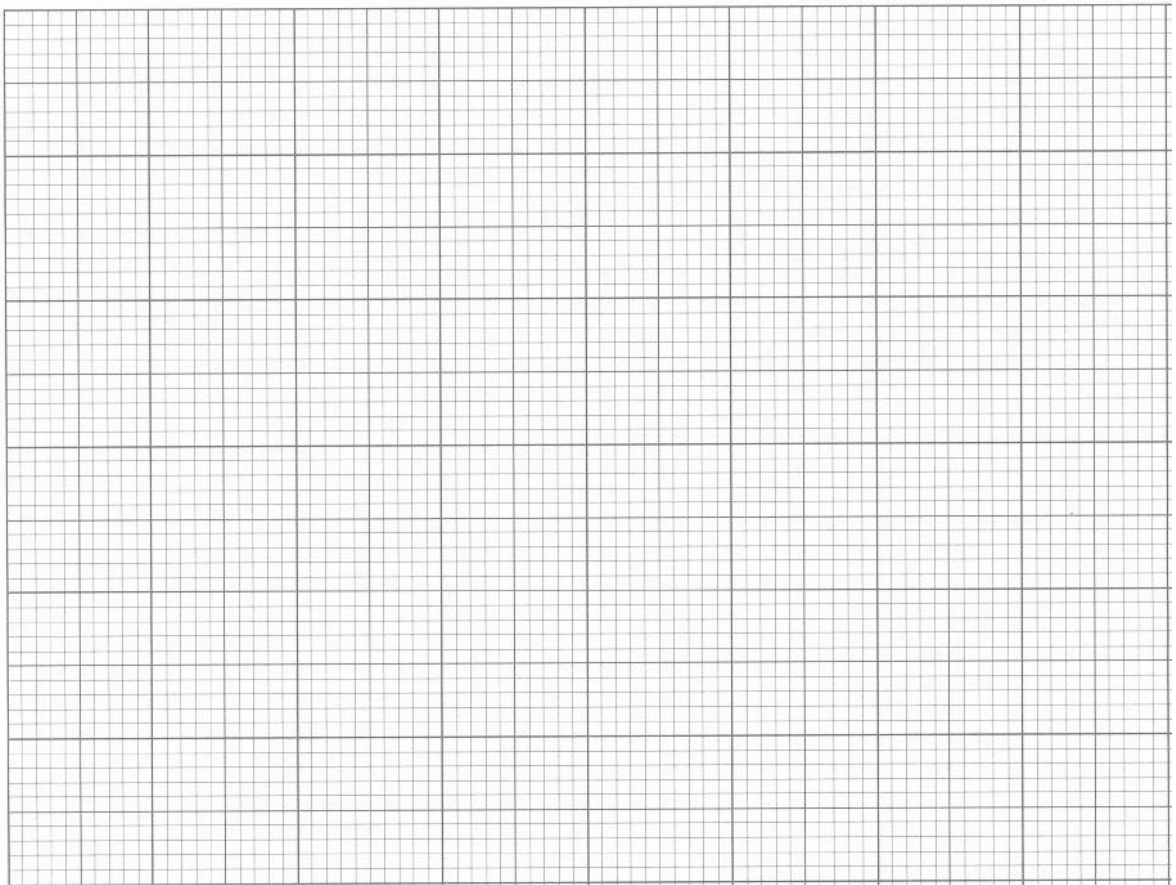
A student investigates the effect of temperature on the rate of a reaction involving an enzyme in the mitochondria.

Their results are shown below.

Temperature (°C)	Rate of reaction (arbitrary units)
0	0
20	10
30	20
40	40
50	10
60	0

(i) Plot the data given in the table on the grid below.

[3]



(ii) Use the points to draw a curve through all the plots.

[1]

(iii) Use the graph to determine the rate of the reaction at 10°C.

Rate of reaction _____ arbitrary units [1]

(iv) The student does not think that the data gives an accurate measurement for the optimum temperature.

Suggest further investigation that the student could do to increase the accuracy of the data.

----- [1]

2. This question is about respiration in yeast.

Complete the sentences by choosing words from this list.

aerobic anaerobic energy enzymes
glucose hormones lactic acid

Yeast contain _____ which are needed for the stages in respiration.

Yeast can be used to make alcohol in the process of fermentation.

Fermentation involves _____ respiration.

All types of respiration release _____ from _____ .

[4]

3(a). Paul's cat has injured its leg.

He takes the cat to the vet.

The vet explains that the cat has an infected leg, probably caused by a puncture wound.

The bacteria in the wound are respiring anaerobically.

Under what conditions will the bacteria respire anaerobically and **not** aerobically?

----- [1]

(b). Anaerobic respiration releases less energy than aerobic respiration.

The energy from respiration is used to make molecules of a substance called ATP.

For every molecule of glucose respired during aerobic respiration, the energy released produces **36** molecules of ATP.

For every molecule of glucose respired during anaerobic respiration, the energy released produces only **2** molecules of ATP.

How many molecules of glucose need to be respired **anaerobically** to produce 36 molecules of ATP?

Put a **ring** around the correct answer.

2

18

34

38

72

[1]

4(a). Yeast is a single-celled microorganism.

Yeast can be grown in a fermenter.

The yeast cells are grown in a liquid containing nutrients.

The nutrients are needed for them to grow and reproduce.

Yeast can carry out both aerobic and anaerobic respiration.

What does yeast produce during **anaerobic** respiration?

Put a **ring** around the **two** correct answers.

carbon
dioxide

ethanol

glucose

light

oxygen

starch

[2]

(b). Some yeast cells are put into a solution in two fermenters, **A** and **B**.

The lid is closed tight so that no air can get in or out of fermenter **A**.

Air containing oxygen is bubbled through fermenter **B**.

A scientist counts the number of yeast cells in samples taken from both fermenters.

She records her results in a table.

Time when samples were taken (hours)	Number of yeast cells in 1 mm ³	
	Fermenter A	Fermenter B
0	100	100
1	200	200
2	300	400
3	350	800
4	390	1600

(i) Describe the results.

[3]

(ii) Cell production needs energy.

The scientist concludes that

“In fermenter A, the yeast cells started to carry out more anaerobic than aerobic respiration.”

Use the data in the table and your understanding of the release of energy in respiration to support this conclusion.

[3]

5(a). Living organisms obtain energy using respiration.

Look at the equations for the two different types of respiration.

They show the energy released from the same amount of glucose.



Write down the names of **Type A** and **Type B** respiration.

Type A _____

Type B _____

[1]

(b). Calculate the ratio:

$$\frac{\text{energy released in Type A}}{\text{energy released in Type B}}$$

Show your working.

ratio = _____

[2]

(c). Jenny is running in a 26 mile marathon race.

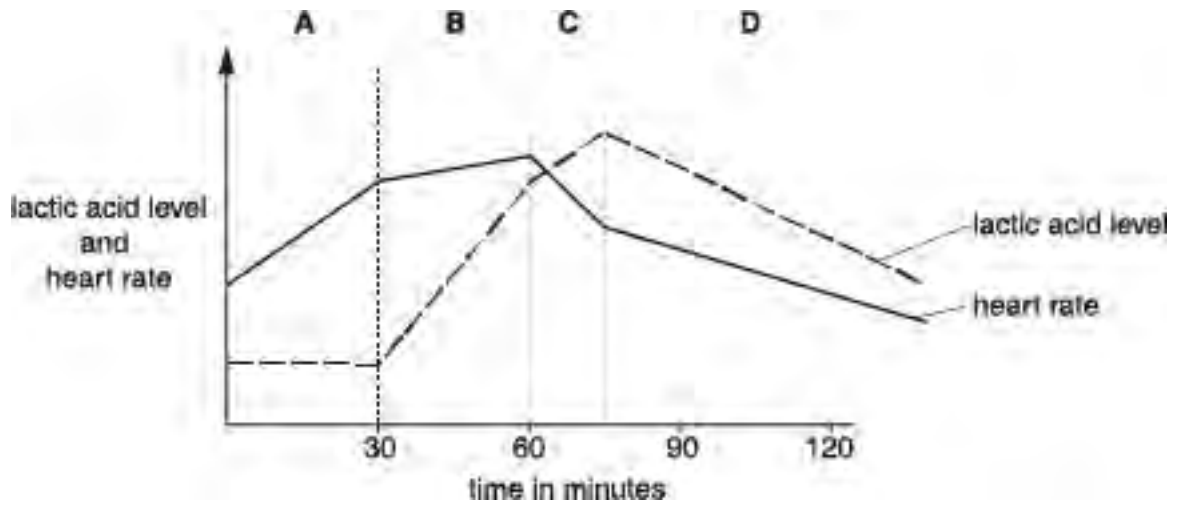
For **most** of the race Jenny respire using **Type A** respiration.

Suggest reasons why this is important.

----- [2]

(d).

The graph shows Jenny's heart rate and the lactic acid level in her blood during a training session.



(i) Jenny makes this conclusion.

There is always the same correlation between my heart rate and my lactic acid level, however long or fast I run.



Discuss how well her conclusion fits the data in the graph.

Use information from sections **A**, **B**, **C** and **D** in your answer.

[4]

(ii) Jenny thinks that some of her data is incorrect.

What should she do to become more confident in her conclusion?

Put a tick (?) in the box next to the correct answer.

Repeat the same training a number of times.

Repeat her training but only run for 60 minutes.

Run more slowly so that her heart rate does not rise too much.

Repeat the same experiment on other runners.

[1]

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Guidance
1	a		Makes ATP ✓	1	If more than one box is ticked, do not award the mark even if the correct box is also ticked
	b	i	1. Plots correct +/- half a square ✓ 2. Appropriate scale ✓ 3. Axes correct and labelled ✓	3	MP3 DO NOT ALLOW axis labels without units
		ii	Line should be smooth and through all plots ✓	1	IGNORE extensions to the line beyond the plots
		iii	6 ✓	1	ALLOW +/- 1 ALLOW an answer +/-1 correctly read from an incorrect plot
		iv	Do more intermediate temperatures ✓	1	DO NOT ALLOW do more temperatures
			Total	7	
2			enzymes (1) anaerobic (1) energy (1) glucose (1)	4	Examiner's Comments Here, candidates were required to select words to complete sentences about respiration in yeast. The question was at least partly accessible to most and the full range of marks was seen.
			Total	4	
3	a		lack of / no oxygen (1)	1	Examiner's Comments Better candidates knew that anaerobic respiration takes place in the absence of oxygen.
	b		18 (1)	1	Examiner's Comments Most could select the number of molecules of glucose needed to produce 36 molecules of ATP.
			Total	2	

Question			Answer/Indicative content	Marks	Guidance
4	a		carbon dioxide (1) ethanol (1)	2	accept any indication of correct response e.g underline delete one mark for each additional incorrect response Examiner's Comments Many candidates failed to read the rubric properly on this question and many had circled glucose and starch.
	b	i	<i>any three from</i> B increases faster than A (1) numbers double in B every hour (1) A doubles in first hour, but then slows (1) Both increase at the same rate in the first hour (1) numbers increase in both / they increase (1) B increases to 1600 (1) A increases to 390 (1)	3	Examiner's Comments This question was aiming to get candidates to describe the results in the table and was worth 3 marks. Centres would be advised to practise this type of question with their candidates as many explained the results rather than describing them.
		ii	<i>any three from:</i> fermenter A uses up the oxygen / there is no oxygen (1) (therefore) they respire anaerobically after an hour (1) energy is needed for cell division / growth / reproduction (1) less energy released from anaerobic respiration ORA (1) so the rate of population growth slows (1)	3	OWTTE Examiner's Comments This was a particularly challenging question and many failed to score.
			Total	8	

Question		Answer/Indicative content	Marks	Guidance
5	a	A= aerobic AND B= anaerobic;	1	<p>Examiner's Comments</p> <p>Correctly answered by many who could correctly spell both aerobic and anaerobic. The substantial minority who did not score the mark seemed not to be aware of the terms at all rather than simply making spelling errors.</p>
	b	2880 / 150; 19.2 / 19 / 19.2:1 / 19:1 / 96:5;	2	<p>Accept 1440 / 75 or 960/50 or 288 / 15 or 96/5 or 480 / 25 for first MP</p> <p>Correct answer = 2 marks Ignore units</p> <p>Examiner's Comments</p> <p>This part was well answered by many candidates. A number of others were able to score 1 mark by showing some working.</p>
	c	To prevent / reduce production of lactic acid; Type A provides a lot of energy / type B provides little energy;	2	<p>accept avoid pain / cramp</p> <p>Examiner's Comments</p> <p>The question required candidates to realise that lactic acid would be produced by anaerobic respiration, and a number scored this marking point by linking this to pain or cramp. Candidates also needed to realise that Type A (aerobic) respiration provides a lot more energy than anaerobic respiration.</p>

Question		Answer/Indicative content	Marks	Guidance
	d	i	4	<p>e.g. In A / 1st section / 0 – 30 mins, one goes up and one stays the same</p> <p>e.g. In B / 2nd section / 30 – 60 mins, both go up</p> <p>e.g. In C / 3rd section / 60 – 75 mins, one goes up, the other goes down</p> <p>e.g. In D / 4th section / 75 – end, both go down</p> <p>Examiner's Comments</p> <p>This was a challenging question which required candidates to understand the difference between positive and negative correlation. Some responses were limited by giving only a trend e.g. in section A the heart rate goes up. The best responses were ones where the consideration of the graph was organised into the four sections on the graph.</p>
		ii	1	<p>Examiner's Comments</p> <p>Part dii was very well answered by the majority of candidates.</p>
			10	

Repeat the same training a number of times.	✓
Repeat her training but only run for 60 minutes.	
Run more slowly so that her heart rate does not rise too much.	
Repeat the same experiment on other runners.	