OCR GCSE 21ST CENTURY BIOLOGY B · J257

BIOLOGY



MARK SCHEME

B4.1 WHAT HAPPENS DURING CELLULAR RESPIRATION? (HIGHER)

SCORE	PERCENTAGE
/40	%

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Question			Answer/Indicative content	Marks	Guidance
1		i	*any two from the following correct parts – max 2 marks* mitochondria; cell membrane; nucleus or DNA; cytoplasm; *one mark for each correct function - max 2 marks* (mitochondria) – contain enzymes / proteins / site of **aerobic** respiration / produce ATP; (cell membrane) – allows gases / CO_2 / O_2 / water / reactants / products to pass through/in and/or out of the cell; (nucleus) – contains DNA / genetic code for **making enzymes** (for respiration); (cytoplasm) – where enzymes are made / site of **anaerobic** respiration;	4	**ignore** 'membrane' on its own **allow** ribosomes the function must be linked to correct structure. **do not accept** contains enzymes for **anaerobic** respiration if cell membrane mark not given, still **accept** correct function. **ignore** substances **accept** proteins instead of enzymes **accept** (ribosomes) site of enzyme/protein manufacture **accept** proteins instead of enzymes **accept** glycolysis/first part of respiration occurs in cytoplasm **Examiner's Comments** Most candidates were able to identify two cell parts correctly but did not always achieve the second mark for the function. They often omitted aerobic or anaerobic from their answer when referring to respiration in the cytoplasm or mitochondria; several stated that enzymes were made in the mitochondria. There was fairly common use of vague terms like substances in relation to the cell membrane along with equally vague statements like *keeps the cell together*, not understanding that the question was asking about the role in respiration. Many candidates who gave nucleus as a cell part then struggled to score for the function as they did not refer to containing genetic code for making enzymes. A few candidates still gave cell wall as an animal cell part and a very small minority gave

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					named plant organelles, or even referred to blood and lungs.
		ii	*any three from* similar shape in methanol and ethanol / tip of methanol and ethanol (which fits into active site) same shape **ethanol** will fit into the <u>active site</u> / has a complementary / similar shape to <u>active site</u>; idea that prevents methanol from binding/ reduces methanol entering active site; methanol is not broken down; idea of reducing the (concentration of) toxic product / harmful substances;	3	**ignore** 'same shape' on its own **ignore** ethanol has same shape as active site **Examiner's Comments** Many candidates failed to score here for lack of precision in their answers e.g. same shape was often seen. Common misconceptions included ideas such as ethanol breaks down methanol, that they both reacted with the enzyme at the same time, that ethanol itself was an enzyme, or that the products of ethanol breaking down would neutralise or remove the toxins produced by methanol. Few candidates appeared to understand that the ethanol would prevent the methanol from binding to the active site. The most common mark achieved was for the idea that ethanol would also fit into the active site of the enzyme. Most candidates did not appear to know what methanol poisoning was, which may have impaired their ability to answer this question successfully. A large proportion talked about lock and key model, but failed to mention the active site and so failed to score a mark.

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		iii	*one from the following* (making) bread; (producing) biogas;	1	**do not accept** alcohol production **accept** sewage (processing) **ignore** biofuel **Examiner's Comments** Bread making appeared to be the most common correct response but a significant minority of those who did score gave biogas. There seemed to be a high level of candidates giving no response, and some rather obscure answers such as microbes under the skin. Making lactic acid, getting energy anaerobically and references to fermentation were common incorrect answers.
			Total	8	

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Question			Answer/Indicative content	Marks	Guidance
2	a		$\frac{2880}{150}$ 19.2 / 19 / 19.2:1 / 19:1 / 96:5;	2	Accept $\frac{1440}{75}$ or $\frac{960}{50}$ or $\frac{288}{15}$ or $\frac{96}{5}$ or $\frac{480}{25}$ for first MP Correct answer = 2 marks Ignore units Examiner's Comments This question is about energy and respiration.
	b		Type A provides a lot of energy / type B provides little energy; To prevent / reduce production of lactic acid / type B produces lactic acid;	2	Accept prevent cramp / pain Examiner's Comments Most candidates realised that Type A released more energy with fewer scoring the lactic acid mark. Weaker answers focussed on the provision of oxygen as being necessary to survive/ complete the race and/or the need for water/hydration. Some candidates didn't answer the question and just discussed what aerobic / anaerobic respiration were and the fact that marathon runners need lots of oxygen.

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Question			Answer/Indicative content	Marks	Guidance
	c	i	A no correlation or description; B positive correlation or description; C negative correlation or description; D positive correlation or description;	4	e.g. In A / 1st section / 0 – 30 mins, one goes up and one stays the same e.g. In B / 2nd section / 30 – 60 mins, both go up e.g. In C / 3rd section / 60 – 75 mins, one goes up , the other goes down e.g. In D / 4th section / 75 – end, both go down **Examiner's Comments** Candidates often lost marks because the sections (A, B, C and D) weren't specified. Some lost marks as they seemed to run out of steam or maybe space as they gave good answers for the first couple of sections then didn't do the others. They can obviously look at graphs and pick out patterns. They talked in terms of increase / decrease and not really in terms of positive/ negative correlation. Correlations were generally not well understood with many thinking that C showed no correlation and D a negative one. Candidates do not appear to understand negative correlation, candidates think that going down is negative correlation, i.e. in D they said negative correlation (instead of positive) as both decrease.
		ii	<table><tr><td>Repeat the same training a number of times.</td><td>✓</td></tr><tr><td>Repeat her training but only run for 60 minutes.</td><td></td></tr><tr><td>Run more slowly so that her heart rate does not rise too much.</td><td></td></tr><tr><td>Repeat the same experiment on other runners.</td><td></td></tr></table>	1	One tick one mark Each extra tick negates one correct tick **Examiner's Comments** Generally candidates knew that confidence in a conclusion means repeating things on the same person. The most common wrong answer was the last box – repeating the same experiment with other runners.
			Total	9	

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Question			Answer/Indicative content	Marks	Guidance
3	a		carbon dioxide + ethanol (1)	1	**both answers required for one mark allow any order** **allow** correct formula for carbon dioxide (CO_2) **Examiner's Comments** Generally this was well answered with most candidates scoring the mark. A few candidates incorrectly suggested that oxygen was produced.
	b		(animal cells) produce lactic acid (1)	1	**do not allow** lactic acid **if** given with carbon dioxide / oxygen **ignore** references to lack of oxygen / use of glucose as the substrate / ref to energy / ATP released **Examiner's Comments** This was also well answered and most candidates could correctly describe the production of lactic acid in animal cells.
	c	i	1500(%) (1)	1	**if no response in the table, check wholepage for the** **Examiner's Comments** The majority of candidates correctly calculated this as 1500. Other answers were seen and on occasions this question was not answered at all. It was unclear whether candidates could not answer the question or whether they had missed it because it was at the bottom of the page and did not have a clear 'space' to write the answer. Candidates needs to be reminded to read all of the paper so that they don't miss questions which may ask them to label something or write somewhere other than in the usual lined space.

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Question			Answer/Indicative content	Marks	Guidance
		ii	*(link between oxygen and respiration):* more oxygen means more aerobic respiration in B / less oxygen means anaerobic respiration / less aerobic respiration in A (1) *(link between energy and cell division):* more energy in B means more cell division / growth / less energy in A means less cell division / growth (1)	2	‘B has oxygen and is aerobic respiration’ = 0 marks ‘B has oxygen and is aerobic respiration. A does not have oxygen and is anaerobic respiration’ = 1 mark **do not allow** ‘reproduction’ (as given in the question) **Examiner's Comments** This question was poorly answered with only the very best candidates able to pick out the important points and present them in a logical sequence. It was a question that demanded the candidate to make comparisons between A and B and therefore comments about only one fermenter was not sufficient to gain credit. The first mark point looked for the link between oxygen and respiration. It was common to see candidates refer to oxygen being present in B and then identify more respiration here. But it was rare to see a specific reference to aerobic and/or anaerobic respiration which made it difficult to be certain that candidates were describing the correct process in the correct fermenter. It was also necessary for the description of respiration to be comparative. This raised the demand of the question so that only the very best candidates scored. The second mark point linked energy and reproduction and was an easier mark to get. However, many candidates fell down by simply repeating the information in the stem of the question, the idea that the yeast in B reproduces faster. For the second mark, candidates were expected to write more than this – and to link the energy with the process of cell division or growth.

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Question			Answer/Indicative content	Marks	Guidance
		iii	**(Level 3)** Answer describes the effect of adriamycin on the cell cycle and includes a detailed explanation of this effect. Explanation is logically sequenced and includes most key points. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **(Level 2)** Answer describes the effect of adriamycin on the cell cycle and includes some explanation of this effect. Explanation may not be logically sequenced or may be missing some key points. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **(Level 1)** Answer may describe the effect of adriamycin on the cell cycle and includes some attempt at an explanation of this effect. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **(Level 0)** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A*** **do not allow** idea that adriamycin stops the chromosomes copying (this is given in the stem) **Indicative scientific points include:** **description:** • rate of growth / reproduction / number of new yeast cells produced will stop / be reduced / stay the same • more cells will die than be produced • this will happen quickly / immediately **explanation:** • (copying of chromosomes) is part of the cell cycle • it takes place during the phase of cell growth • chromosome replication / DNA copying • two strands of DNA / chromosomes separate • nucleus divides • new (daughter) cells are formed • mitosis • adriamycin prevents this happening • cell division / mitosis can not take place **ignore** ref to individual cell growth **ignore** ref to meiosis **Examiner's Comments** A six-mark extended-writing question on the paper. Candidates generally made a good attempt at this question with most scoring at least a Level 1 answer. The majority of candidates correctly identified that the adriamycin would slow down the reproduction of the yeast. Some candidates developed this further and described how the number of cells would be likely to level off for a while and then decrease, as more cells would die than be produced. Some also made reference to the fast-acting nature of the adriamycin. A

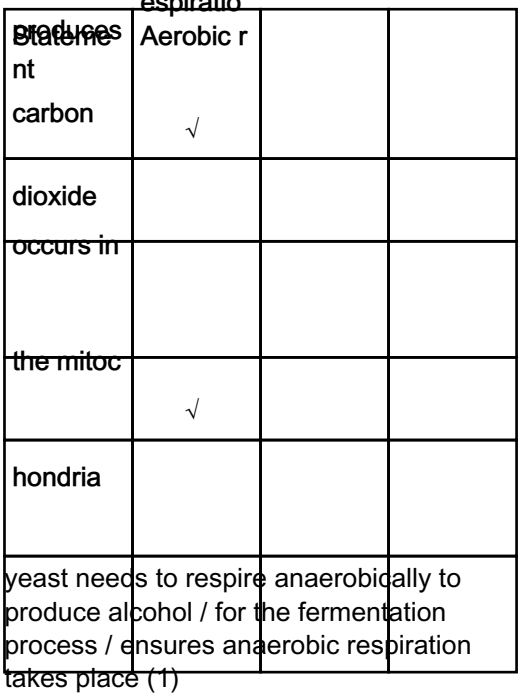
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					very small number of candidates believed that the adriamycin would speed up the rate of reproduction in the yeast cells. With regards to an explanation, the majority of the candidates recognised that the adriamycin would stop the cells dividing but their reason was very commonly that which was given in the stem, i.e. the idea that the chromosomes would not be able to copy themselves. A significant number of candidates continually repeated this point as their explanation without developing it at all. This meant that they were unable to move beyond Level 1. To move to Level 2 or 3, candidates needed to make some reference to the events in the cell cycle. Many candidates correctly stated mitosis as the process that was occurring and it was pleasing to see some extremely detailed and accurate descriptions of this process, with reference to DNA replication, the chromosomes separating and the formation of two new daughter cells. Candidates need to learn the importance of sequencing their answers as it was very common to see lots of points just randomly scattered throughout the response and it was difficult to credit these responses with maximum marks. A small but significant number of candidates confused mitosis with meiosis.
			Total	11	

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			ion acid c respirat uses Anaerobi glucose n respiratio	3	Mark by row: 5 rows correct 3 marks 4 rows correct 2 marks 3 rows correct 1 mark A row does not score if it contains an additional **incorrect** tick. For **'uses glucose'** row: - **accept** three ticks. - **accept** two ticks, but **only** if they appear in 'aerobic respiration' **and** 'anaerobic respiration' columns

Question			Answer/Indicative content	Marks	Guidance
4	a				
	b		yeast needs to respire anaerobically to produce alcohol / for the fermentation process / ensures anaerobic respiration takes place (1)	2	
			(layer of oil) prevents contact (between yeast / glucose) with air / oxygen / prevents aerobic respiration (1)		

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Question			Answer/Indicative content	Marks	Guidance
	c	i	*Conclusion 1* Idea that temperature affects the reaction (1) *Explanation 1* (as temperature increases) **enzymes** and **substrates** have more (kinetic) energy/ (as temperature increases) more collisions between **enzyme** and **substrates/** as temperature increases / at optimum temperature, enzymes will work better / faster ORA (1) *Conclusion 2* at 45(^{o}C), idea that as time increases, the **rate** of reaction decreases / is low (1) *Explanation 2* the glucose is used in the reaction / less glucose is available for respiration (1)	4	**accept** conclusions in any order **accept** glucose for substrate **accept** more **enzyme-substrate** complexes **accept** temperature is a limiting factor to **enzyme** action **ignore** references to denaturation **accept** build-up of alcohol poisons yeast
		ii	*Any one from:* Idea that each bubble may be different (in size) (1) Idea that bubbles are difficult to count (1)	1	**accept** difficult to count accurately / human error
		iii	any method which allows gas to be collected (to measure its volume) e.g. use a burette / use a (gas) syringe	1	**accept** measure mass-loss **accept** over-water, **ignore** under water **ignore** references to a balloon
	d		Idea of vigorous exercise	1	**accept** named exercise e.g. running / swimming etc. **accept** swimming underwater
			Total	12	

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