

GCSE

Further Additional Science B

Unit **B762/02**: Modules B6, C6, P6 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2014

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All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotation	Meaning
BP	Blank Page – this annotation must be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.

Question	Answer	Marks	Guidance
1 a	other microorganisms might enter (1) fermentation is anaerobic (1)	2	
b i	(actual alcohol content =) 11.79 (%) (1) (Tim is correct), as actual alcohol content is lower than maximum possible / maximum possible = 14.9 (%) (1)	2	ignore he is correct as not all the sugar has been changed to alcohol allow 11.8 (%) yes, as 11.79 is less than 14.9 = (2) only made 11.79 not 14.9 = (2)
ii	alcohol level has killed the yeast (1)	1	ignore the yeast has died unless qualified ignore references to enzymes
	Total	5	

Question	Answer	Marks	Guidance
2 a	any three from natural selection (1) resistance appears due to mutation (1) all bacteria except resistant ones are killed (1) resistant bacteria reproduce (1) plus the more doses given then the greater (percentage / number of bacteria show) resistance (1)	4	 resistant bacteria survive and reproduce = (2) ignore positive correlation unless answer states the variables ignore bacteria become resistant quicker do not allow ORA
	Total	4	

Question	Answer	Marks	Guidance
3	<p>[Level 3] Answer includes explanation of why sweeter sugars are used and includes an advantage and disadvantage of the immobilised enzyme. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Answer includes reference to the breakdown of sugars and includes an advantage or a disadvantage of the type of enzyme OR Answer includes an advantage and a disadvantage of the immobilised enzyme Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Answer includes reference to the breakdown of sugars or includes an advantage or a disadvantage of the immobilised enzyme. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to A</p> <p>Indicative scientific points may include:</p> <p>reason for breaking down sucrose:</p> <ul style="list-style-type: none"> • sucrose converts sucrose to glucose and fructose • these sugars are sweeter <p>explanations:</p> <ul style="list-style-type: none"> • less sugar is needed in the food • increase profit / lower calorie foods <p>disadvantages:</p> <ul style="list-style-type: none"> • immobilised enzyme has a higher optimum temperature • higher temperature for the same rate • more energy needed to get the same rate of breakdown <p>advantages:</p> <ul style="list-style-type: none"> • mixture not contaminated with enzyme when it is immobilised / easier to reuse the enzyme • with immobilised enzyme it can be a continuous process • do not waste production time between batches <p>allow will not denature at higher temperature not higher rate with free enzyme / immobilised</p> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
Total		6	

Question	Answer	Marks	Guidance										
4 a	<table border="1"> <tr> <td data-bbox="331 252 1010 316">Bacteria naturally make human insulin.</td> <td data-bbox="1010 252 1070 316"></td> </tr> <tr> <td data-bbox="331 316 1010 411">Bacteria contain plasmids of DNA in their cytoplasm.</td> <td data-bbox="1010 316 1070 411">✓</td> </tr> <tr> <td data-bbox="331 411 1010 515">Bacteria reproduce asexually to make clones of themselves.</td> <td data-bbox="1010 411 1070 515">✓</td> </tr> <tr> <td data-bbox="331 515 1010 579">Bacteria do not get diabetes.</td> <td data-bbox="1010 515 1070 579"></td> </tr> <tr> <td data-bbox="331 579 1010 643">Bacteria are resistant to insulin.</td> <td data-bbox="1010 579 1070 643"></td> </tr> </table>	Bacteria naturally make human insulin.		Bacteria contain plasmids of DNA in their cytoplasm.	✓	Bacteria reproduce asexually to make clones of themselves.	✓	Bacteria do not get diabetes.		Bacteria are resistant to insulin.		1	
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b i	restriction (enzymes) (1)	1	allow endonuclease ignore restricted										
ii	gene A (1) contains 'sticky ends' / unpaired bases (1) complementary to the ends on the plasmid to join with it / complementary base pairing(1)	3	allow exposed bases allow A pairs with T and TTAA are exposed so need AATT to bind with them ignore simple description of gene A										
Total		5											

Question	Answer	Marks	Guidance
5 a	closest to highest populated areas AW(1) (more) sewage / detergents released into the lake (1) (oxygen depleted by) eutrophication / decomposition (by bacteria) (1)	3	ignore other named pollutants
b	any two from Lake Valtern is higher in PCBs / PCB pollution (from paper factories) takes a long time to disappear (1) PCBs do not easily break down / persistent (1) builds up in food chains / bioaccumulation (1)	2	allow less PCBs in Lake Malaren ignore pollution is higher so takes longer to disappear
	Total	5	

Question	Answer	Marks	Guidance
6 a	C (1)	1	
b	C ₂ H ₂ F ₄ (1)	1	order of symbols unimportant
c	chlorine atoms/(free) radicles are regenerated (1) idea that can repeat the reactions many times (1)	2	allow C/ acts as a catalyst / chlorine atoms are always made(1) not chloride allow it is a chain reaction (1)
	Total	4	

Question	Answer	Marks	Guidance
7 a	a reaction that involves both oxidation and reduction (1)	1	allow reaction that involves electron loss and electron gain / reaction involving electron transfer (1) not positive electrons ignore electrons are either gained or lost
b	The substance oxidised is iron / Fe The substance reduced is chlorine / Cl₂ The oxidising agent is chlorine / Cl₂ The reducing agent is iron / Fe	2	all correct two marks two or three correct one mark not chloride / ions
c	any two from idea that zinc / galvanisation provides a barrier / prevents water or oxygen getting to it (1) zinc is a sacrificial metal (1) idea that zinc loses electrons more readily (than iron) (1) idea that zinc reacts instead of iron (1)	2	accept air allow zinc is more reactive than iron
Total		5	

Question	Answer	Marks	Guidance
8 a	solid – idea that ions in fixed positions (and cannot move) (1) molten – idea that ions free (to move) (1)	2	ignore reference to electrons / atoms ignore reference to electrons in one ions are free (to move) but in the other they are not / ions need to move for electrolysis to occur = 1 mark
b	$\text{Pb}^{2+} + 2\text{e}^{-} \rightarrow \text{Pb}$ formulae (1) balancing – dependent on correct formulae including electrons (1)	2	allow any correct multiple e.g. $2\text{Pb}^{2+} + 4\text{e}^{-} \rightarrow 2\text{Pb}$ allow e instead of e^{-} allow = or \rightleftharpoons for arrow not 'and' or & for + allow one mark for correct balanced equation with minor errors in case, subscript and superscript e.g. $\text{Pb}2+ + 2\text{e}^{-} \rightarrow \text{PB}$ (1) allow $\text{Pb}^{2+} \rightarrow \text{Pb} - 2\text{e}^{-}$
c i	idea that as both time and current increase so does the mass of copper made (1) but idea that mass of copper is directly proportional to both current and time (2)	2	allow mass directly proportional to current (1) allow mass directly proportional to time (1) allow as time doubles so does mass of copper and as current doubles so does mass of copper (2)
ii	1.6 (g) (1)	1	
	Total	7	

Question	Answer	Marks	Guidance																														
9	<p>Level 3 Completes an evaluation involving two comparisons, one of which shows fermentation to be advantageous and the other showing hydration AND chooses the best process with some reasoning. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>Level 2 Completes an evaluation involving two comparisons, one of which shows fermentation to be advantageous and the other showing hydration Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>Level 1 Completes an evaluation including one comparison. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>Level 0 Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to A/A*.</p> <p>Comparisons:</p> <table border="1" data-bbox="1182 344 1995 970"> <thead> <tr> <th></th> <th>fermentation</th> <th>hydration</th> </tr> </thead> <tbody> <tr> <td colspan="3">Fermentation is advantageous</td> </tr> <tr> <td>renewability</td> <td>starting material is renewable</td> <td>raw material is non-renewable</td> </tr> <tr> <td>cost of conditions</td> <td>conditions are cheap to use</td> <td>conditions expensive to generate</td> </tr> <tr> <td colspan="3">Hydration is advantageous</td> </tr> <tr> <td>atom economy</td> <td>atom economy is low /</td> <td>atom economy is high /</td> </tr> <tr> <td>percentage yield</td> <td>low percentage yield</td> <td>high percentage yield</td> </tr> <tr> <td>type of process</td> <td>a batch process so less convenient</td> <td>a continuous process, so can run 24/7</td> </tr> <tr> <td>cost of purifying</td> <td>expensive purification process</td> <td>no expensive purification needed</td> </tr> <tr> <td>availability of raw materials</td> <td>starting materials from plants not available in large quantities in the UK</td> <td>raw material available from cracking in the UK</td> </tr> </tbody> </table> <p>allow only one side of the argument to be given as long as it is a comparative statement.</p> <p>Choice of process with some reasoning:</p> <ul style="list-style-type: none"> can choose either process but the advantage quoted from above needs justifications <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>		fermentation	hydration	Fermentation is advantageous			renewability	starting material is renewable	raw material is non-renewable	cost of conditions	conditions are cheap to use	conditions expensive to generate	Hydration is advantageous			atom economy	atom economy is low /	atom economy is high /	percentage yield	low percentage yield	high percentage yield	type of process	a batch process so less convenient	a continuous process, so can run 24/7	cost of purifying	expensive purification process	no expensive purification needed	availability of raw materials	starting materials from plants not available in large quantities in the UK	raw material available from cracking in the UK
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Total		6																															

Question	Answer	Marks	Guidance
10 a	saponification (1)	1	allow hydrolysis (1) soap making is not sufficient
b	idea that addition reaction takes place / bromine reacts with a (carbon-carbon) double bond / dibromo compound is formed (1) when bromine is combined it is colourless / dibromo compound is colourless / colour changes from orange / brown to colourless(1)	2	allow reaction shown using displayed formulae (1) bromine reacts with a double bond and the product is colourless = 2 marks
Total		3	

Question	Answer	Marks	Guidance
11 a i	zero / no voltage [1]	1	allow 0
ii	charge stored increases (until it becomes fully charged) [1] voltage increases (until it is equal to the supply voltage) [1]	2	allow they increase / both increase / increase and increase = 2 marks
b	this needs four diodes [1] in the form of a (rectifying) bridge / square [1]	2	allow 2 marks for a diagram showing 4 diodes (1) in a square (1)
Total		5	

Question	Answer	Marks	Guidance
12	<p>[Level 3] Identifies the conductor AND describes how the resistance changes AND links this to kinetic theory Quality of written communication does not impede communication of the science at this level (5 – 6 marks)</p> <p>[Level 2] Identifies the conductor and describes how the resistance changes OR Identifies the conductor and links the working of the conductor to kinetic theory OR Describes how the resistance changes and links the working of the conductor to kinetic theory Quality of written communication partly impedes communication of the science at this level (3 – 4 marks)</p> <p>[Level 1] Identifies the conductor OR recognises the resistance changes OR links the working of the conductor to kinetic theory Quality of written communication impedes communication of the science at this level (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to A*.</p> <p>Indicative scientific points may include:</p> <p>Kinetic theory</p> <ul style="list-style-type: none"> • collision of electrons with atoms makes atoms vibrate more • if atoms vibrate more there are more collisions so more resistance • this increased atomic vibration increases the temperature of the conductor <p>Resistance</p> <ul style="list-style-type: none"> • the resistance changes • at low current the resistance is lower than at high current • correct use of $R=V/I$ • correct values of resistance calculated <p>Identification of the conductor</p> <ul style="list-style-type: none"> • conductor is a non-Ohmic conductor / bulb / wire that gets hot <p>Use the L1, L2, L3 annotations in scoris. Do not use ticks.</p>
Total		6	

Question	Answer	Marks	Guidance
13 a	NOR (gate) [1]	1	
b	AND (gate) [1]	1	
c i	B and C [1]	1	mark answer on answer line first if answer line blank allow correct answer indicated in list more than one scores 0 marks
ii	111 [1] 111 [1]	2	
d	a small current / voltage is used in the logic circuit / for the (230V) bulb a large current / voltage is needed [1] relay (switch) protects / isolates the gate from high voltage / high current / 230 V circuit / mains voltage / mains current [1]	2	ignore references to volts moving
	Total	7	

Question	Answer	Marks	Guidance
15 a	Similarities: all reduce the pH (1) by the same amount / to the same level (1) Differences: Idea of length of lag period differs (1) length of time for the reaction to finish differs (1)	3	ignore references to rate allow they all stop at 3.8 (1) allow they all drop to 3.8 = 2 marks ignore A changes the pH quicker
b	the larger the animal the higher the limit / AW (1) cows used for milk have a lower limit / cows used for milk do not fit the trend because the poison gets into milk (very) quickly / does not have time to break down in the milk (1)	2	ORA
c i	any two from (length of) time (milk left with bacteria) / temperature (of incubation) / source / type of milk / same number of bacteria added/ same volume of milk (1)	1	allow amount of bacteria allow amount of milk
ii	Milan: idea that two out of the three readings is below the legal limit / below 0.5 (1) calculation of average as 0.45 (1) the average is below the legal limit / below 0.5 (1)	4	

Question	Answer	Marks	Guidance
	<p>Shaz: (at least) one result is above the legal limit for human milk / above 0.5, in A, B and C (1)</p> <p>all the results averages are very close to the legal limit (1)</p> <p>appreciation that only three readings were taken each time / AW(1)</p>		<p>allow one result for A and averages for B and C are above limit</p>
Total		10	

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001