OCR
Oxford Cambridge and RSA

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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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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	**[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) **[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) **[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) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A** **Indicative scientific points may include:** reason for breaking down sucrose: • sucrase converts sucrose to **glucose** and **fructose** • these sugars are sweeter explanations: • less sugar is needed in the food • increase profit / lower calorie foods disadvantages: • immobilised enzyme has a higher optimum temperature • higher temperature for the same rate • more energy needed to get the same rate of breakdown advantages: • 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 **allow** will not denature at higher temperature **not** higher rate with free enzyme / immobilised **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
4 a	<table><tr><td>Bacteria naturally make human insulin.</td><td></td></tr><tr><td>Bacteria contain plasmids of DNA in their cytoplasm.</td><td>✓</td></tr><tr><td>Bacteria reproduce asexually to make clones of themselves.</td><td>✓</td></tr><tr><td>Bacteria do not get diabetes.</td><td></td></tr><tr><td>Bacteria are resistant to insulin.</td><td></td></tr></table>	1	
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 **PCB**s / **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	$C_2H_2F_4$ (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 / Cl_2** The oxidising agent is **chlorine / Cl_2** 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	Pb^{2+} + $2e^-$ → Pb formulae (1) balancing – dependent on correct formulae including electrons (1)	2	**allow** any correct multiple e.g. $2Pb^{2+}$ + $4e^-$ → 2Pb **allow** e instead of e^- **allow** = or ⇆ for arrow **not** 'and' or & for + **allow** one mark for correct balanced equation with minor errors in case, subscript and superscript e.g. Pb2+ + $2e^-$ → PB (1) **allow** Pb^2+ → Pb - 2e-
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**	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>9</td><td>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)

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)
Level 1
Completes an evaluation including one comparison.
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)</td><td>6</td><td>This question is targeted at grades up to A/A*.

Comparisons:

<table>
<tr><th></th><th>fermentation</th><th>hydration</th></tr>
<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>
</table>

allow only one side of the argument to be given as long as it is a comparative statement.

Choice of process with some reasoning:
• can choose either process but the advantage quoted from above needs justifications

Use the L1, L2, L3 annotations in Scoris; do not use ticks.</td></tr>
<tr><td></td><td>Total</td><td>6</td><td></td></tr>
</table>

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	**[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) **[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) **[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) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A*.** **Indicative scientific points may include:** **Kinetic theory** • 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 **Resistance** • 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 **Identification of the conductor** • conductor is a non-Ohmic conductor / bulb / wire that gets hot **Use the L1, L2, L3 annotations in scoris.** **Do not use ticks.**
	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
14 a	(output voltage) (4) **6** **8** **4** [2]	2	all 3 correct scores [2] 1 or 2 correct [1]
b	thermistor [1] as its resistance changes then the voltage changes / if its resistance increases, voltage increases (or vice-versa) [1]	2	 **ignore** references to temperature **additional marking point:** output voltage depends on the ratio of resistance of **X** to R3 (1)
c	**any three from** as the light level increases the resistance decreases / ORA [1] the relationship is non-linear AW (1) changes at high light levels are difficult to measure accurately [1] (because) at high light levels the changes in resistance are small [1]	3	 **e.g.** 9 ➔ 12 small resistance change [1]
	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
	Shaz: (at least) one result is above the legal limit for human milk / above 0.5, in A, B and C (1) all the results averages are very close to the legal limit (1) appreciation that only three readings were taken each time / AW(1)		**allow** one result for A **and** averages for B and C are above limit
	Total	**10**	

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