OCR
RECOGNISING ACHIEVEMENT

GCSE

Chemistry B

General Certificate of Secondary Education

Unit **B642/02:** Modules C4, C5, C6 (Higher Tier)

Mark Scheme for June 2012

Oxford Cambridge and RSA Examinations

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Annotations

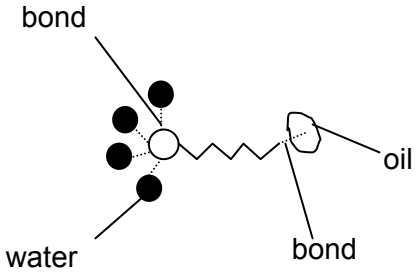
Annotation	Meaning
	Correct response
	Incorrect response
	Benefit of doubt
	Benefit of the doubt not given
	error carried forward
	Omission Mark
	Ignore
	reject
	contradiction

Subject-specific Marking Instructions

/	alternative and acceptable answers for the same marking point
(1)	separates marking points
allow	answers that can be accepted
not	answers which are not worthy of credit
reject	answers which are not worthy of credit
ignore	statements which are irrelevant
( )	words which are not essential to gain credit
__	underlined words must be present in answer to score a mark (although not correctly spelt unless otherwise stated)
ecf	error carried forward
AW	alternate wording
ora	or reverse argument

Question			Answers	Marks	Guidance
1	(a)		provides nitrogen (1) nitrogen used to make plant protein / nitrogen used to make amino acids (1)	2	**allow** replaces essential elements (used by previous crops) / provides essential elements / provides phosphorus / provides potassium **ignore** provides nutrient / nitrates / phosphates / ammonium **allow** nitrates or ammonium used to make plant protein / nitrates or ammonium used to make amino acids **allow** provides phosphorus used to make ATP / RNA / DNA (1) provides nitrogen and phosphorus is only worth one mark; to get a second mark there must be a correct link between the name of the essential element and the chemical it makes within the plant
	(b)	(i)	sulfuric (acid) **and** ammonia (solution) (1)	1	**allow** sulphuric (acid) **and** ammonium hydroxide (1) **allow** any order of reagents **allow** H_2SO_4 **and** NH_3 / NH_4OH **allow** sulfuric acid and ammonium carbonate or ammonium hydrogencarbonate / H_2SO_4 **and** $(NH_4)_2CO_3$ / NH_4HCO_3 **not** ammonium
		(ii)	the acid neutralises the alkali / ora (1)	1	**allow** hydrogen ions react with hydroxyl ions **allow** acid reacts with alkali **allow** because acid has a low**er** pH **allow** number of hydrogen ions increases / concentration of hydrogen ions increases **allow** number of hydroxide ions decreases / concentration of hydroxide ions decreases **allow** the solution becomes more acidic
	(c)		relative atomic mass of ammonium sulfate 132 (1) **but** % is 21.2 (2)	2	**allow** full marks for correct answer on the answer line whether or not there is any working out **allow** 21% or any other correctly rounded up or down calculator values **allow** e.c.f. (mass of nitrogen in formula / M_r) x 100 (1)
			Total	**6**	

Question			Answers	Marks	Guidance
2	(a)		recycled (1)	1	**allow** (unreacted nitrogen and hydrogen) gases are reacted again **allow** a description of recycling eg gas goes back round to be put through again **allow** the gas is re-used **in the reactor**
	(b)	(i)	decreases / goes down / gets lower / AW (1)	1	**allow** ora if lower temperature clearly stated
		(ii)	pressure 500 (atmospheres), temperature 350 (^{o}C) (1)	1	**allow** correct answers indicated in table if answer lines are blank
	(c)	(i)	increases rate of reaction (1)	1	**allow** more product made in a shorter time **allow** can use lower temperature / can use lower pressure **not** increases the **percentage** yield **ignore** increases the yield
		(ii)	reduces wages bill / reduce labour costs (1)	1	**ignore** no labour costs / you do not have to pay people **ignore** do not have to pay the start-up costs **allow** less labour intensive
		(iii)	(higher pressure) increases yield (1)	1	**allow** shifts position of equilibrium to the right / shifts equilibrium in the forward reaction **allow** high pressure has high rate / increases the rate / increases collision frequency **allow** high pressure gives biggest % yield / makes more ammonia **ignore** gives a high percentage yield
			Total	**6**	

Question			Answers	Marks	Guidance
3	(a)		hydrophobic end of detergent molecule is attracted to oil or fat / hydrophobic end forms intermolecular forces with oil or fat / hydrophobic end bonds to oil or fat (1) hydrophilic end of detergent is attracted to water / hydrophilic end forms intermolecular forces with water / hydrophilic end bonds to water to oil or fat (1)	2	**ignore** references to dirt **allow** as alternative to bonds sticks to, attached, joined the hydrophobic end sticks into oil is **not** sufficient **all** marks can be awarded from a **labelled** diagram but to get two marks must clearly show bonding to rather than surrounded by  **if no other marks awarded** **allow** tail is surrounded by oil molecules and the head by water molecules
	(b)		**any two from:** dyes not damaged or made paler (1) more delicate clothes can be washed / less shrinkage / so clothes do not lose their shape (1) saves energy / saves electricity / saves fuel in the home (1) less greenhouse gases / reduces the carbon footprint (1) enzymes in washing powder not denatured (1)	2	 **allow** colours won't run **ignore** doesn't ruin or damage the clothes unless qualified **ignore** better for the environment unless qualified **ignore** less pollution **allow** enzymes work better at low temperatures **ignore** takes less time
	(c)		a solvent other than water (is used to clean clothes) (1)	1	**allow** water not used **allow** uses an organic solvent **but** uses a solvent on its own is not sufficient
			Total	**5**	

Question			Answers	Marks	Guidance
4	(a)		C_{60} (1)	1	**allow** correct answer ticked, circled or underlined in list if answer line blank
	(b)		free electrons / delocalised electrons / electrons that can move (between the layers) / mobile electrons (1)	1	**ignore** spare electrons **not** reference to ionic bonding
	(c)		this makes a large surface area available / idea that the catalyst is attached to the nanotube / idea that molecules are trapped within the nanotube / idea that molecules are attached to the surface of the nanotube (1)	1	
			Total	**3**	

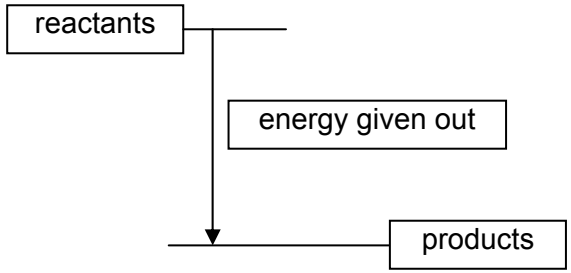
Question			Answers	Marks	Guidance
5	(a)		280 (seconds) (1)	1	
	(b)		0.00075 (1)	1	**allow** 0.0008
	(c)		the reactant which is used up (first of all) (1)	1	**allow** reactant not in excess / reactant that limits the amount of product made
	(d)		**any three from:** (ethanoic acid) is a weak**er** acid / doesn't ionise as much (1) fewer particles / less crowded particles (1) appreciation that the particles are hydrogen ions (1) fewer collisions (1)	3	assume answer refers to ethanoic acid unless hydrochloric acid is specified **allow** hydrochloric acid is a strong**er** acid **allow** two marks for there is lower concentration of hydrogen ions **allow** two marks for fewer collisions involving hydrogen ions no need for reference to collision frequency or successful collisions to be awarded a mark
			Total	**6**	

Question			Answers	Marks	Guidance
6	(a)		1.60 (g) (1)	1	unit **not** needed **allow** 1.6 (g)
	(b)		0.025 (1)	1	
	(c)		carbon-12 (1)	1	**allow** correct answer ticked, circled or underlined in list if answer line blank
			Total	**3**	

Question			Answers	Marks	Guidance
7	(a)		$2SO_2 + O_2 \rightleftharpoons 2SO_3$ correct formulae (1) correct balancing (1)	2	**allow** any correct multiple including fractions **allow** = or → instead of ⇌ **not** and or & instead of + balanced equation mark dependent on correct formulae but **allow** one mark for balanced equation with some minor errors in subscript and case eg 2SO2 + o2 → 2So3
	(b)		(catalyst has) no effect on (position of equilibrium) (1)	1	
	(c)		a lower temperature decreases yield and decreases rate of reaction: a lower temperature increases yield but decreases rate of reaction: ✓ a higher temperature increases yield and increases rate of reaction: a higher temperature decreases yield and decreases rate of reaction: a higher temperature increases yield but decreases rate of reaction: (1)	1	more than one tick = 0 marks
			Total	**4**	

Question			Answers	Marks	Guidance
8	(a)	(i)	2.08 (g) (1)	1	if answer line left blank **allow** correct answer ticked, circled or underlined in list
		(ii)	1440 (2) **but** 2 × 0.30 × 40 × 60 **or** 2 × 0.15 × 80 × 60 (1)	2	**allow** one mark for 24 **allow** one mark for 720 **allow** one mark for 2880
	(b)	(i)	ions (1) do not move (1) – this is dependent on ions	2	**allow** ions in fixed positions (2) **allow** does not have free ions (2) **allow** charged particles cannot move (1) **allow** electrons cannot move / does not have mobile electrons / no free electrons (1) lead bromide is covalent = 0 marks intermolecular forces = 0 marks
		(ii)	$2Br^- - 2e^- \rightarrow Br_2$ Br_2 (1) balancing (1)	2	**allow** any correct multiple including fractions **allow** $2Br^- \rightarrow Br_2 + 2e^-$ **allow** one mark for correct equation with minor errors in subscripts, superscripts and case e.g. $2Br^- - 2e^- \rightarrow$ BR2
			Total	**7**	

Question			Answers	Marks	Guidance
9	(a)		iron + oxygen + water → hydrated iron(III) oxide (1)	1	**allow** = instead of → **not** and / & / instead of + **not** iron(III) as a reactant **allow** mix of correct formulae and names $Fe + O_2 + H_2O \rightarrow Fe_2O_3.H_2O$
	(b)		idea of stops oxygen reaching surface / idea of stops water reaching the surface (1)	1	**allow** acts as a barrier to air / acts as a barrier to oxygen / acts as a barrier to water / idea of stopping oxygen reacting with iron / idea of stopping water reacting with iron acts as a barrier or protects the iron is **not** sufficient
	(c)		(redox reactions involve) oxidation and reduction (1)	1	**allow** (reaction involves) loss and gain of electrons / electron transfer
			Total	**3**	

Question			Answers	Marks	Guidance
10	(a)		top box – reactants middle box – energy given out bottom box – products all **three** correct (2) **but** **one** or **two** correct – 1 mark	2	
	(b)		$H_2 \rightarrow 2H^+ + 2e^-$ / $H_2 - 2e^- \rightarrow 2H^+$ correct formulae including electrons (1) balancing (1)	2	**allow** = instead of → **not** and / & / instead of + **allow** any correct multiple balancing mark is dependent on correct formulae, **but** **allow** 1 mark for a balanced equation with a minor error in subscripts / case eg H2 → $2H^+ + 2e^-$ allow e for electron

Question			Answers	Marks	Guidance
	(c)		**any two from:** produces energy efficiently / direct energy transfer (1) light (weight) / idea that it's lighter so spacecraft can carry a bigger payload (1) they can be used continuously / do not need to be recharged (1) idea that fuel cell uses hydrogen and/or oxygen which spacecraft has to carry anyway (1) water produced is drunk by astronauts (1)	2	**allow** fewer energy transfers (1) **ignore** reference to cost / density fuel cell is efficient is **not** sufficient **allow** not heavy **ignore** takes up less space **allow** fuel cells will not run out **ignore** renewable energy source **ignore** readily available unless qualified for a spacecraft water is the only waste product is insufficient **but allow** if linked to a use within the spacecraft **ignore** reference to pollution
			Total	**6**	

Question			Answers	Marks	Guidance
11	(a)		calcium hydrogencarbonate (1)	1	**allow** correct answer ticked, circled or underlined in list but answer line takes precedence
	(b)		strong acid would react with the metal of the heater element or washing machine / strong acid will corrode the metal (1)	1	**allow** ora **allow** reacts with heater / reacts with metal / reacts with washing machine **ignore** strong acid will damage the heater element / metal / washing machine **ignore** strong acid with dissolve the heater element / metal / washing machine **ignore** strong acid will erode the heater element / metal / washing machine
	(c)		calcium ions / Ca^{2+} / magnesium ions / Mg^{2+} / calcium and magnesium ions removed (1) replaced by sodium ions / Na^{+} (1)	2	**allow** Ca^{2+} replaced by Na^{+} (2) **not** Ca^{+}
			Total	**4**	

Question			Answers	Marks	Guidance
12	(a)		distillation (1)	1	**allow** correct answer ticked, circled or underlined in list if answer line is blank
	(b)		**any three from:**	3	
					allow reverse arguments where appropriate **ignore** unqualified references to cost
			hydration uses non-renewable source / fermentation uses a renewable source (1)		**allow** fermentation uses sugars from plants that can be grown again / hydration uses ethene made from a finite source / fermentation uses a sustainable source
			hydration uses ethene readily available from crude oil / fermentation uses sugars readily available from plants (1)		
			fermentation made by batch / hydration by continuous (1)		
			hydration makes pure ethanol / fermentation needs ethanol to be purified (1)		**allow** fermentation needs distillation to get pure ethanol
			hydration is faster than fermentation / ora (1)		
			hydration give a higher percentage yield / ora (1)		
			hydration has higher energy costs / hydration uses a higher temperature / hydration uses a higher pressure / ora		**allow** fermentation takes place close to room temperature / fermentation takes place at atmospheric pressure / hydration uses a high temperature / hydration uses a high pressure
			hydration does not give any waste / fermentation gives waste / fermentation makes carbon dioxide (1)		**allow** hydration has a higher atom economy
			Total	**4**	

Question			Answers	Marks	Guidance
13	(a)		subsidence / AW (1)	1	**allow** collapse of buildings / mine collapses / cracks in buildings / land slides into holes mined
	(b)		**at anode**: chlorine / Cl_2 (1) **at cathode**: hydrogen / H_2 (1)	2	**ignore** Cl **ignore** H **allow** 1 mark for hydrogen at anode and chlorine at cathode
			Total	**3**	

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