OCR
RECOGNISING ACHIEVEMENT

GCSE

Chemistry A

General Certificate of Secondary Education

Unit **A323/02:** Ideas in Context plus C7 (Higher Tier)

Mark Scheme for June 2011

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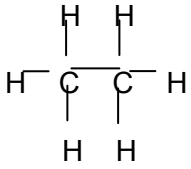
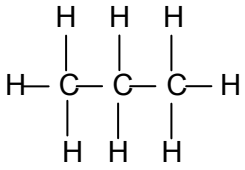
MARK SCHEME:

Question			Answer	Mark	Guidance
1	a		idea that much more lithium is required to make car batteries than smaller batteries (1) idea that there are likely to be more electrically powered cars in the future (1)	2	ignore reference to laptops/mobile phones unless qualified Allow idea that more environmentally friendly cars will be used in the future for second mark
	b		lithium compounds are toxic (1) so could cause pollution as mined/extracted/disposed of (in landfill) (1) OR electricity used to recharge the batteries/extract the lithium must be generated (1) electricity generation causes pollution (1) OR lithium has to be mined/dug out of ground (1) this causes environmental damage (1)	2	In each pair the second mark cannot be given without the first mark Allow description of environmental damage
	c	i	electricity used to recharge lithium ion batteries/run the car/extract lithium has to be generated (1) generation of electricity (by burning fossil fuels) releases carbon dioxide into the air (1)	2	Ignore fossil fuels used to power mining machinery, transport etc Ignore references to pollution unqualified as carbon dioxide
		ii	use renewable/zero emission/carbon neutral methods to generate electricity (1) e.g. wind/wave/solar/nuclear (1)	2	Ignore 'green' methods / environmentally friendly / sustainable Ignore improvements to car or battery design **Accept** any valid renewable/zero emission source
	d	i	lithium is more reactive than iron/carbon (1)	1	ignore reference to lithium chloride bond strength allow lithium is higher in reactivity series than carbon / iron / lithium cannot be / is too reactive to be displaced by carbon
		ii	$Li^+ + e^- \rightarrow Li$ (1) $2Cl^- \rightarrow Cl_2 + 2e^-$ (1)	2	**allow** multiples as long as equation balances allow $2Cl^- - 2e^- \rightarrow Cl_2$ allow **both** equations $Cl^- \rightarrow Cl + e^-$ and $Cl + Cl \rightarrow Cl_2$ for second mark
		iii	50 x 42.5/7 (1) = 304 (1)	2	give one mark for RFM LiCl as 42.5 **allow** 303.6 / 303.57 but do not allow any more sig figs give both marks for correct answer without working
			Total	[13]	

Question			Answer	Mark	Guidance
2	a		C_2H_6  propane 	4	One mark for each of the four correct responses. Spelling of propane must be correct for this mark. For molecular formula must be clear difference between upper case of C and H and smaller 2 and 6 All bond lines must be shown in structural formulae
	b		$C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$ (1)	1	allow multiples that balance
	c		when bonds are made energy is released (1) when bonds are broken energy is taken in (1) in an exothermic reaction energy released is more than energy taken in (1) QWC one mark for ideas presented in a logical order (1)	4	allow bond making is exothermic allow bond breaking is endothermic QWC mark does not depend on getting any of the other three marks, but the answer must address the question
			Total	[9]	

3	a		it is a catalyst (1) it speeds up the reaction / it provides an alternative route / with lower activation energy (1)	2	 ignore idea of helps the reaction to take place allow helps the reaction to go faster
	b		$CH_3COOH + C_8H_{17}OH \rightleftharpoons CH_3COOC_8H_{17} + H_2O$ (1)	1	either order for reactants and for products allow multiples if balanced allow reverse writing of equilibrium equation

	c		initially forward reaction produces ester and water/products (1) as ester and water/products are formed they go back to carboxylic acid and alcohol/reactants (1) rate of forward reaction decreases as rate of backward reaction increases (1) until two rates are equal (at equilibrium) (1)	**4**	for the first and second marks the answer must imply a time line ie only reactants at start, then form products, then these go back to reactants allow explicit idea of both **forward and backward** reactions taking place at same time for 1 mark **instead of first two marking points** **allow** speed instead of rate
			Total	**[7]**	

Question			Answer	Mark	Guidance
4	a		**any two from:** put phosphoric acid/lime scale remover and indicator in flask (1) add (standard) sodium hydroxide solution until all of phosphoric acid has been neutralised/colour change is seen/end point is reached (1) measure volume of sodium hydroxide solution added from a burette (1)	2	Allow correct general description of a titration instead of a description specific for the phosphoric acid-sodium hydroxide titration. If put phosphoric acid in burette max 1 mark (unless dissolves and made up to known volume first).
	b		**any two from:** to identify (and discard) any outliers (1) to calculate a mean/average (as the best estimate) (1) to check that the batch is well mixed/to test the bulk of material/test uniformity of batch (1)	2	do not allow ideas of comparing **different batches** ignore idea of increasing reliability unless average/mean is mentioned ignore idea of more accurate do not allow idea that it reduces the errors/outliers
	c		by looking at the range of the results / look to see how large the range is / see how close the titration values are to each other	1	allow look at the spread around the average allow work out the standard deviation ignore references to equipment
	d		for quality control / to match information on the label / to ensure product is safe to use / to ensure product is effective / so that it does not cause damage (to kettle) / so that chemical is not wasted	1	no mark for 'safety' unqualified Accept to prevent possibility of litigation
	e	i	(25.0 x 60.0/1000 =) 1.5 g	1	
		ii	(3x1) + 31 + (4x16) (1) = 98 (1)	2	Two marks for correct answer without working.
		iii	98 g H_3PO_4 reacts with (3x40 =) 120 g NaOH (1) mass H_3PO_4 = 1.5 x 98/120 (1) = 1.225 g (1)	3	**allow** ecf from (i) and (ii). **allow** 3 marks for correct answer without working. **allow** answers 1.2, 1.22 and 1.23. **allow** 2 marks for answer 3.675 / 3.67 / 3.68 / 3.7.
			Total	[12]	

5	**a**	**i**	$S(l) + O_2(g) \rightarrow SO_2(g)$ correct formulae (1) then balanced (1) correct state symbols (1)	**3**	**allow** multiples balance mark is dependent on getting formulae correct state symbols must be lower case and on line or subscript (not superscript) and mark is dependent on getting correct formulae
		ii	provides an alternative route (1) with a lower activation energy (1)	**2**	ignore reference to it being a catalyst ignore reference to bond breaking
	b		**any two from:** to protect the public/workers/people (1) to protect the environment (1) from the corrosive nature of sulfuric acid (1)	**2**	ignore 'health and safety' if not qualified ignore references to toxic or harmful
			Total	**[7]**	

Question			Answer	Mark	Guidance
6	**a**	**i**	Method 1/ethene (is least sustainable) (1) corn/waste biomass/material for other methods is renewable/is obtained from plant sources/ can be grown (1) ethene will one day run out/is finite/is not renewable (1)	**3**	ignore reference to 'green'

		ii	one correct factor plus explanation of **how this affects sustainability**: 1 atom economy(1) **less** waste in producing other chemicals from reactants **more** sustainable (1) 2 by-products (1) by-products that are not useful/are harmful/need to be disposed of make the process **less** sustainable (1) 3 energy input/output(1) **more** energy required/less energy produced the **less** sustainable (1) 4 environmental impact (1) **more** harm caused to the environment the **less** sustainable(1) 5 health and safety risks (1) **more** likely to cause harm to people/**more** measures that have to be taken to ensure safety the **less** sustainable (1) 6 social/economic benefits (1) **more** benefit the **more** sustainable (1)	**2**	Mark one pair from the six possibilities – a factor plus an explanation. The factor is for first mark then a matching explanation is for second. The explanation must say whether the factor increases or decreases the sustainability and how it does this. Do not allow 'not sustainable' in place of 'less sustainable'.
	b		**any two from:** in method 2 there is competition in the use of feedstock/corn/land for food and to make ethanol (1) method 3 uses feedstock/waste biomass that would otherwise be thrown away/has no other uses (1) competition between different uses of the same feedstock/land leads to price increase / where there is no competition prices should not rise (1)	**2**	ora To get the second mark the answer must say more than just that method 3 uses waste biomass
			Total	**[7]**	

			Total	**[55]**	

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