OCR
RECOGNISING ACHIEVEMENT

GCSE

Chemistry A

General Certificate of Secondary Education

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

Mark Scheme for January 2013

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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.

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Annotations

Used in the detailed Mark Scheme:

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
(1)	separates marking points
not/reject	answers which are not worthy of credit
ignore	statements which are irrelevant - applies to neutral answers
allow/accept	answers that can be accepted
(words)	words which are not essential to gain credit
words	underlined words must be present in answer to score a mark
ecf	error carried forward
AW/owtte	credit alternative wording / or words to that effect
ORA	or reverse argument

Available in scoris to annotate scripts:

	indicate uncertainty or ambiguity
BOD	benefit of doubt
CON	contradiction
	incorrect response
ECF	error carried forward
	draw attention to particular part of candidate's response
	draw attention to particular part of candidate's response
	draw attention to particular part of candidate's response
NBOD	no benefit of doubt

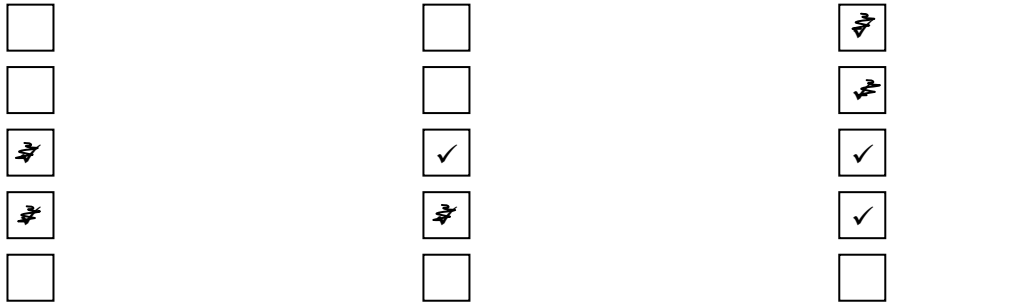
R	reject
✓	correct response
~	draw attention to particular part of candidate's response
^	information omitted

Subject-specific Marking Instructions

a. Accept any clear, unambiguous response (including mis-spellings of scientific terms if they are *phonetically* correct, but always check the guidance column for exclusions).

b. Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.

e.g. for a one-mark question where ticks in the third <u>and</u> fourth boxes are required for the mark:



This would be worth 1 mark. *This would be worth 0 marks.* *This would be worth 1 mark.*

c. The list principle:
If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, e.g. one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.

d. Marking method for tick-box questions:

If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.
If there is at least one tick, ignore crosses and other markings. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses. Credit should be given according to the instructions given in the guidance column for the question. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

e.g. if a question requires candidates to identify cities in England:

Edinburgh	
Manchester	
Paris	
Southampton	

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third <u>should be blank</u> (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
Score:	**2**	**2**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**NR**

e. For answers marked by levels of response:

i. **Read through the whole answer from start to finish**

ii. **Decide the level** that **best fits** the answer – match the quality of the answer to the closest level descriptor

iii. **To determine the mark within the level**, consider the following:

Descriptor	Award mark
A good match to the level descriptor	The higher mark in the level
Just matches the level descriptor	The lower mark in the level

iv. Use the **L1**, **L2**, **L3** annotations in Scoris to show your decision; do not use ticks.

Quality of Written Communication skills assessed in 6-mark extended writing questions include:

- appropriate use of correct scientific terms
- spelling, punctuation and grammar
- developing a structured, persuasive argument
- selecting and using evidence to support an argument
- considering different sides of a debate in a balanced way
- logical sequencing.

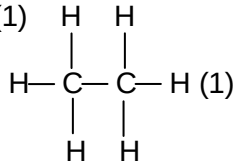
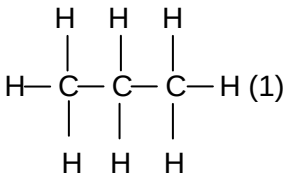
Question			Answer	Marks	Guidance
1	(a)		**any two from:** burning ethanol produces less carbon dioxide (than petrol) / ora (1) carbon dioxide from petrol is from plants grown long ago (1) carbon dioxide from bioethanol is removed by growing more plants (to produce more bioethanol) / this is returning to the air the carbon dioxide taken in by the plants used to make the bioethanol (1)	2	Allow using = burning Allow bioethanol releases less carbon dioxide Ignore reference to burning fossil fuels unqualified allow idea of carbon neutral only if explained
	(b)	(i)	32 000 000 x 15 000 / 30 000 (1) = 16 000 000 / 16 million (1)	2	If 16 million calculated but then used to calculate a wrong answer, allow 1 mark Allow 2 marks for correct answer without working
		(ii)	**any two from:** only a small proportion of/not all cars could use bioethanol/not enough bioethanol for all cars (1) there are not enough UK crops/not enough land (to make bioethanol for all UK cars) (1) using much of UK crops would impact on food supply (1) crops/bioethanol could be imported to increase number of cars in UK using bioethanol (1)	2	Do not allow 'could only be used for 5% of UK cars' Do not allow idea that car engines would need modification allow only enough bioethanol for about 10 million cars for first marking point
	(c)	(i)	RAMs C_2H_5OH = 46 and CO_2 = 44 (1) 46 kg ethanol produces 2 x 44 = 88 kg carbon dioxide (1) 1 kg ethanol produces 88 / 46 = 1.9 kg carbon dioxide (1)	3	Allow 2 CO_2 = 88 in first marking point no marks for incorrect calculation of 1.9
		(ii)	burning (same mass of) bioethanol produces less energy than petrol (1) bioethanol gives fewer miles (per kg/gallon than petrol) (1)	2	Allow carbon dioxide is released during production of bioethanol
	(d)		more bioethanol used as fuel (1) plus any one explanation from: waste biomass does not have any other use (1) using waste biomass will not compete with food use/will not affect food prices / extra land not needed to produce bioethanol (1) crops/wheat to make bioethanol do have to be grown/imported (1)	2	Ignore reference to more sustainable
			Total	**13**	

Question			Answer	Marks	Guidance
2	(a)		energy level of reactants is higher than that of products / energy level decreased during the reaction (1); so energy is given out/released / exothermic / heat given out (1)	2	Allow less energy to break reactant bonds than energy given out when product bonds formed
	(b)		(burning) match supplies activation energy (1) (activation) energy is needed to break bonds/start the reaction (1)	2	Do not allow idea that the match is the activation energy
	(c)	(i)	4 x 435 = 1740 (1) 2 x 498 = 996 (1) energy used = (1740+996) = 2736 (1)	3	Allow all 3 marks for correct answer without working
		(ii)	(2736-3466 =) -730	1	**allow** with or without a minus sign allow ecf from (c)(i)
			Total	**8**	

Question			Answer	Marks	Guidance
3	(a)		it is a catalyst (1) it speeds up the reaction / it provides another route for the reaction / it lowers the activation energy (1)	2	
	(b)		$C_2H_5COOH + C_4H_9OH \rightleftharpoons C_2H_5COOC_4H_9 + H_2O$	1	
	(c)		*Any four from:* forward reaction produces ester and water (1) ester and water react to form carboxylic acid and alcohol / reaction goes forwards and backwards / reaction is reversible (1) rate of forward reaction decreases as rate of backward reaction increases (1) until two rates are equal/forward rate equals reverse rate (1) a dynamic equilibrium is formed (1)	4	Allow carboxylic acid reacts with alcohol to make ester and water
			Total	**7**	

Question			Answer	Marks	Guidance
4	(a)		**any two from:** add an indicator (1) add (standard) sodium hydroxide solution until all of phosphoric acid has been neutralised/until colour changes/until end point (1) measure the volume of sodium hydroxide solution added (from a burette) (1)	2	Do not allow addition of phosphoric acid to sodium hydroxide Do not allow measure amount of sodium hydroxide
	(b)		see how large the range is / see how close the titration values are to each other / small uncertainty if range is small	1	ignore reference to reliability/accuracy/precision
	(c)		for quality control / to match information on the label / to ensure product is safe / to make sure product works / to avoid damage to the kettle	1	
	(d)	(i)	20.0 x 100 / 1000 = 2.0 g	1	Allow 2.0 or 2 with no working
		(ii)	H = 1 P = 31 O = 16 (1) (3x1) + 31 + (4x16) = 98 / 3 + 31 + 64 = 98 (1)	2	no mark for 98 without working
		(iii)	98 g H_3PO_4 reacts with 3x40 = 120 g NaOH (1) mass H_3PO_4 = 2.0 x 98/120 (1) = 1.63 g (1)	3	**allow** ecf from (i) and (ii). **allow** 3 marks for correct answer without working. **allow** answer 1.6 allow max 2 marks if use 40 instead of 120 for NaOH
			Total	**10**	

Question			Answer	Marks	Guidance
5	(a)		*nitrogen* makes the process more sustainable / it is sustainable (1) because the supply of air is not limited / air is renewable (1) *hydrogen* makes the process less sustainable / it is not sustainable (1) will one day run out / comes from a finite source/crude oil/natural gas (1)	4	do not allow idea that hydrogen comes from water
	(b)	(i)	$CH_4 + H_2O \rightarrow CO + 3H_2$	2	one mark for all correct formulae and one mark for balance no balance mark if formulae incorrect formulae must use upper case and smaller numbers if plus or arrow missing max 1
		(ii)	reaction is reversible (so some product goes back to reactants) (1) at equilibrium both product and reactants present (1) reaction does not reach equilibrium / gasses pass through too quickly for all to react (1)	2	ignore reference to the remaining gases being recycled
			Total	**8**	

Question			Answer	Marks	Guidance
6	(a)		ethane (1)  C_3H_8 (1) 	4	molecular formula must be completely correct ie capital C and H with noticeably smaller numbers
	(b)		$2C_4H_{10} + \mathbf{13}0_2 \rightarrow \mathbf{8}CO_2 + \mathbf{10}H_2O$	1	
	(c)		ethane has unreactive C-C/C-H bonds/has no O-H bond so does not react (1) ethanol has an –OH (functional) group so is more reactive (than ethane) (1) water reacts faster than ethanol because bonds more polar/it has two O-H bonds (1) QWC: answer links ideas into logical order (1)	4	allow ethanol reacts slower than water because it only has one O-H but water has two/water bonds more polar
			Total	**9**	

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