

Chemistry A

General Certificate of Secondary Education

Unit **A173/01**: Module C7 (Foundation Tier)

Mark Scheme for June 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
<u>words</u>	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:

	correct response
	incorrect response
BOD	benefit of doubt
NBOD	no benefit of doubt
ECF	error carried forward
0 , L1 , L2 , L3	indicate level awarded for a question marked by level of response
A	information omitted
CON	contradiction
R	reject

	indicate uncertainty or ambiguity
	draw attention to particular part of candidate's response

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 and 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 should be blank (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	x	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	x		✓		✓	✓		✓	
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)		measurements 4.2 and 5.6 from the diagram (1) Rf value for spot 2 = $4.2/5.6 = 0.75$ (1)	2	allow +/- 0.2 for each value allow 2 marks for 0.75 without working allow ecf for correct calculation from ONE incorrect measurement for 2 nd mark
	(b)		B (1) and E (1)	2	
	(c)		no/partly correct (no mark) one dye moves less far / only one moves further (1) identifies first spot as the one that travels less far / identifies second spot as the only one that travels further (1)	2	allow only one Rf value is higher allow references to appropriate Rf values to identify the spot but must refer to distance travelled
			Total	6	

Question			Answer	Marks	Guidance
2	(a)	(i)	B	1	
		(ii)	D	1	
		(iii)	A (1) and E (1)	2	
		(iv)	E	1	
			Total	5	

Question			Answer	Marks	Guidance
3	(a)		<p>Level 3 (5–6 marks) Answer gives a detailed description of how the conditions affect the reaction with some explanation of these effects. Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) Answer discusses how most of the conditions affect the reaction OR gives some explanation of how one of the conditions affects the reaction. Quality of written communication partly impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) Answer gives some indication of how the conditions affect the reaction. Quality of written communication impedes communication of the science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to E</p> <p>Indicative scientific points may include:</p> <p>effects</p> <ul style="list-style-type: none"> • catalyst is used to increase rate • high temperature increases rate • high pressure increases rate • recycling gases means reactants used again <p>explanations</p> <ul style="list-style-type: none"> • high rate of reaction makes more ammonia per unit time • catalyst lowers activation energy • high temperature/pressure increases collisions • high temperature makes particles move faster • unreacted gases are recycled so reactants are not wasted • it is a reversible/equilibrium reaction • increasing pressure increases yield/pushes equilibrium to right/make more ammonia <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
	(b)		<p>fertiliser is washed into rivers causing pollution/eutrophication (1) production of ammonia has increased / use of fertilisers has increased (1) plus a link from more ammonia/fertilisers to more pollution (1)</p>	3	<p>allow description of eutrophication</p>
			Total	9	

Question			Answer	Marks	Guidance
4	(a)		citric acid + sodium hydrogen carbonate lower left line (1) sodium citrate + carbon dioxide + water upper right line (1)	2	
	(b)		less (1) gained from (1) endothermic (1)	3	
	(c)		reaction produces a gas / carbon dioxide so bubbles will appear (1) reaction is endothermic / takes in heat/energy so test tube feels cold (1)	2	allow does have bubbles / gives a gas / gives CO ₂ and doesn't get hot for 1 mark.
			Total	7	

Question			Answer	Marks	Guidance
5	(a)	(i)	<p>Level 3 (5–6 marks) Gives a detailed description of procedure with the purpose of some steps explained. Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) Describes most stages of basic procedure OR describes some stages with extra detail/purpose. Quality of written communication partly impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) Describes some stages in basic procedure. Quality of written communication impedes communication of the science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to C</p> <p>Purpose:</p> <ul style="list-style-type: none"> • burette and pipette used for accurate measurement • white tile to see colour change better • indicator used to determine end point • drop by drop addition to make sure do not go beyond end point • swirl for thorough mixing • rough titration to give idea of where end point is so accurate titrations can be done faster • consecutive titrations agree to give accurate result. <p>Details of procedure:</p> <ul style="list-style-type: none"> • using pipette • use safety pipette filler • use of white tile • add drop by drop near end point • swirl the mixture • colour change shows neutralisation • do a rough titration • do accurate titrations until consecutive agree <p>Basic procedure</p> <ul style="list-style-type: none"> • put one of acid/alkali into burette • measure one of acid/alkali into flask • add indicator to flask • add one solution to the other • until indicator changes colour • note volume added <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>

Question			Answer	Marks	Guidance
5	(a)	(ii)	look at closeness/range of results (1) connects uncertainty with closeness/range (1)	2	
	(b)	(i)	→ magnesium chloride + water	1	both required allow correct formulae ignore incorrect formulae
		(ii)	58	1	
		(iii)	$15.1 \times 73.0/1000$ (1) $= 1.1$ (1)	2	give both marks for 1.1 without working give one mark for 1.102/1.10 without working give one mark for 1102.3
		(iv)	$1.1 \times 58/73$ (1) $= 0.87$ (1)	2	allow ecf (i.e. (iii) $\times$ (ii)/73) allow 0.9/0.87397.....
	(c)		batch A is OK because each tablet is within the allowed range (1) batch B is unsatisfactory because the tablets contain less (than the minimum permitted amount) (1) batch C is unsatisfactory because the tablets contain more (than the maximum permitted amount) (1) batch D is unsatisfactory because some tablets contain more (than the maximum permitted amount) (1)	4	each answer must say indicate whether the batch is satisfactory or unsatisfactory and explain why do not credit calculation and use of average/mean values
			Total	18	

Question			Answer	Marks	Guidance								
6	(a)	(i)	<div style="text-align: center;">$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{O}-\text{H} \\ \\ \text{H} \end{array}$</div>	1	allow –OH not –HO								
		(ii)	alcohol	1									
	(b)		<table border="1"><tr><td>methanol</td><td>oxygen</td><td>carbon dioxide</td><td>water</td></tr><tr><td>1</td><td>3</td><td>1</td><td>2</td></tr></table>	methanol	oxygen	carbon dioxide	water	1	3	1	2	2	all four correct for 2 marks two or three correct for 1 mark
methanol	oxygen	carbon dioxide	water										
1	3	1	2										
	(c)		fuel / solvent	1									
			Total	5									

Question		Answer	Marks	Guidance
7	(a)	<p>Level 3 (5–6 marks) Answer deals fully with sustainability in terms of feedstock, and another factor. Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) Answer deals fully with sustainability in terms feedstock or partially in terms of feedstock and another factor. Quality of written communication partly impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) Answer offers some explanation of sustainability. Quality of written communication impedes communication of the science at this level.</p> <p>Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to C</p> <p>Indicative scientific points may include:</p> <p>feedstock/raw materials</p> <ul style="list-style-type: none"> • method 1 uses ethene from crude oil • natural gas/crude oil is finite • method 2 uses sugar • more sugar beet/cane can be grown • in terms of feedstock fermentation is more sustainable <p>fuel/energy input</p> <ul style="list-style-type: none"> • method 1 uses high temperature which needs a lot of fuel/energy • burning fuel releases pollutant gases • method 2 uses low temperature with uses little fuel • in terms of fuel needed fermentation is more sustainable <p>equipment</p> <ul style="list-style-type: none"> • method 1 is carried out at high pressure and so needs reaction vessel to withstand this/has safety issues • method 2 is carried out at normal/atmospheric pressure • making reaction vessel for method 1 uses more resources than making reaction vessel for 2 • in terms of equipment fermentation more sustainable <p>other ideas</p> <ul style="list-style-type: none"> • method 1 has a better atom economy than method 2 and is therefore more sustainable in this aspect • method 2 releases carbon dioxide which is a greenhouse gas, but so does method 1 as fuel is burned <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>

Question			Answer	Marks	Guidance
7	(b)	(i)	yeast is killed by a high concentration of ethanol	1	
		(ii)	distillation	1	
	(c)		enzymes are denatured at high temperature / 300°C (1) ethene with steam has low rate of reaction at / low temperature 30°C (1)	2	allow yeast destroyed / killed at high temperature allow steam not produced at 30°C
			Total	10	

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