OCR
Oxford Cambridge and RSA

GCSE

Chemistry A

Unit **A173/02**: Module C7 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2016

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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.

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 RM Assessor 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
NBOD	no benefit of doubt
R	reject
	correct response

L1 , L2 , L3	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 should be blank (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 RM Assessor 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		idea that fertiliser/bulk chemicals are in demand/ needed/made/used on a large scale / made continuously OR drugs/fine on a small scale / batch process; (1) monitoring of purity is easier for fine processes; (1) links fertiliser/bulk chemicals to idea of one product **OR** drugs/fine chemicals to the need to change products; (1)	**any 2**	 **BOD** drugs need to be pure **Ignore** 'consumed by humans' without further explanation

Question			Answer	Marks	Guidance
	b		**[Level 3]** Discusses the use of methane, energy and the reaction linked to sustainability. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Identifies aspects of the process that affect sustainability with clear links. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Makes a statement to link one aspect of the process to sustainability. 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 C** **Indicative scientific points may include:** **Sustainability links about using methane** • methane comes from a fossil fuel • methane is in finite supply/will run out / is non-renewable **Sustainability links about energy** • multi-stage processes use more energy • high temperature uses energy • high temperature uses fuel/methane • methane/fossil fuel is burned to heat process / provide energy **Sustainability links about the reaction** • waste product/CO_2 [accept CO_2 from burning methane/] causes climate change (**Ignore** pollutant/harms the environment) • atom economy low/ 'only' 15% **BOD** references to 'atom efficiency' but ignore 'efficiency' alone **Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.**

Question			Answer	Marks	Guidance
1	c	i	box 2; (1) box 4; (1)	2	
		ii	correct answer : 11% (2) Uses 4 OR 36; (1)	2	Accept any number of decimal places 11.111111r
		iii	by-product/oxygen has another use; ORA(1) waste product is thrown away / must be disposed of; (1)	2	**BOD** 'By-product can be re-used' Waste product mark is for an active event 'thrown away' not a passive 'not needed/ not used'
			Total	14	

Question			Answer	Marks	Guidance
2	a	i	587 1134 (ignore signs); (2) + − ie correct signs (1)	3	
		ii	(-) 547	1	**Allow** ECF from a i [i.e.. difference between the two values.] if sign given, must be correct for ecf.

Question			Answer	Marks	Guidance
2	b		**[Level 3]** Identifies fluorine as an exception **AND** Makes a correct statement about element trends **AND** Makes a correct statement about compound trends Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Identifies fluorine as an exception **AND** Makes a correct statement about element trends **OR** compound trends Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Makes a correct statement to show why Len is partly right. 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:** **Statement about Exception** • fluorine is the exception [may be by implication] • fluorine (bond energy) is too low • fluorine (bond energy) is lower than chlorine • Links values for fluorine and chlorine to Len's idea **Statement about Element trends** • bond energies/bond strengths go down in general • compares values from chlorine to iodine, doesn't just quote numbers **Ignore** 'There is ***no*** trend in the elements **Statement about Compound trends** • Len is right for the compounds • Bond energies get lower down the group **Ignore** statements about reactivity of the elements • Bonds get weaker down the group. **Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.** **ALTERNATIVE** **[Level 3]** Identifies HBr/HCl as anomalous **AND** fluorine **[Level 2]** Identifies HBr/HCl as anomalous **BUT NOT** fluorine
			Total	10	

Question			Answer	Marks	Guidance
3	a	i	24.4-24.6; (1) 25.0-27.7; (1)	2	**Accept:** 24.6-24.4; **Accept:** 27.7-25.0; **Accept** 25 instead of 25.0
		ii	Acid A no more repeats AND acid B needs more repeats; (1) Acid B range is large / results are not concordant / not consistent / not repeatable/ results vary OR Acid A results are close together / AW ; (1)	2	**Allow** Acid A 'No' AND Acid B 'Yes' for 1 mark **Accept** ''Acid B results not reliable'' **Ignore** "Acid B results not accurate'' **Ignore** "Acid B results contain outliers'' **Ignore** "because of the range"

Question			Answer	Marks	Guidance
	b		**[Level 3]** Both strength **and** concentration correct for **most** of the acids. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Both strength **and** concentration correct for **some** of the acids. **OR** Makes correct statements about concentration for **most** acids **or** strength for **most** acid**s**. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Makes correct statements about concentration **OR** strength for **some** acid**s**; 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:** **Level 3 indicative points** • Acid C is a weak acid AND has a low concentration. • Acid D is a strong acid and more concentrated than C • Acid E is a weak acid and high in concentration • Acid F is a strong acid AND has a low concentration. • Accept comments about dibasic acids **Concentration** • Acid C and acid F have the lowest concentration. • Acid C and acid F have the same concentration • Acid E has the highest concentration. • Acid D is more concentrated than C or F • Acid D is less concentrated than acid E **Strength** • Acid D is a strong acid • Acid F is a strong acid • Acid C is a weak acid • Acid E is a weak acid • Acid C is the weakest acid • Acid D and F are the strongest acids • Acid E is stronger than acid C Statements such as “Acid C&F have ***lowest*** concentration” OR “Acid D and F are the ***strongest*** acids” qualify as statements about MOST of the acids. If reasoning faulty, give the lower mark of the level **Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.**
				10	

Question			Answer	Marks	Guidance
4	a		4; (1)	1	
	b		sweet 2 contains an unsafe dye; (1) unknown dye in sweet 3 / Sweet 3 doesn't match up with a safe dye/ no reference for dye in sweet 3; (1)	2	Must have correct reference to sweet 2 and sweet 3
	c		distance travelled by spot; (1) distance travelled by solvent; (1)	2	
	d		to see the spots / spots are colourless; (1)	1	**Accept** any reasonable argument about making it easier to see **Accept** 'show', **Ignore** 'find or identify'
	e	i	dye C; (1) has the highest peak/ recorder response; (1)	2	The reason must be in terms of peak/line height or recorder response, ie obvious what is to be measured. **Ignore** 'highest result' If a correct **and** an incorrect reason given, do not award the second mark. Eg discusses retention time.
		ii	Idea of matching [with a reference dye] (1) retention time/Rf value (1)	2	 **Ignore** 'recorder response'
		iii	[qualitative because] can show which dyes are used; (1) [quantitative because] can show how much of each dye is used; (1)	2	**Allow (1) only** for '[quantitative because] shows how many dyes are used.' **Ignore** statements about retention time or recorder response. 'shows which dyes are used and how much' = (2)
			Total	12	

Question			Answer	Marks	Guidance
5	a		D (1)	1	
	b		A and D (1)	1	**Both** required
	c		**3 from:** Reflux; (1) Discusses vapour/gas/steam/evaporate [even if wrong species];(1) [Vapour] condenses / turn back to liquid; (1) Returns to flask / doesn't escape; (1) [To allow] further reaction; (1)	3	Remember to look for annotations on the diagram.
	d		distillation; (1) [purify using] a tap [separating] funnel / add drying agent; (1)	2	Allow answers in diagrammatic form. **Ignore** evaporation / heating Drying – must convey the idea of ***how*** the liquid is dried. **Ignore** name of drying agent ['add NaCl as a drying agent' =1, but 'add NaCl' with no further comment = 0] **Ignore** 'drying' without reference to drying agent
			Total	7	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>6</td><td>a</td><td></td><td>reaction is reversible / explains reversible idea / ammonia breaks down again into nitrogen and hydrogen; (1)

[reaches] equilibrium (1)</td><td>2</td><td></td></tr>
<tr><td></td><td>b</td><td></td><td><table>
<tr><th>Condition</th><th>Increases rate only</th><th>Increases yield only</th><th>Increases both rate and yield</th></tr>
<tr><td>High temperature</td><td>✓</td><td></td><td></td></tr>
<tr><td>High pressure</td><td></td><td></td><td>✓</td></tr>
<tr><td>Use of a catalyst</td><td>✓</td><td></td><td></td></tr>
<tr><td>Recycling unreacted hydrogen and nitrogen</td><td></td><td>✓</td><td></td></tr>
</table></td><td>3</td><td>All 4 rows correct (3)
3 or 2 rows correct (2)
1 row correct (1)</td></tr>
<tr><td></td><td>c</td><td></td><td>box 1; (1)
box 5; (1)</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>7</td><td></td></tr>
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