OCR
Oxford Cambridge and RSA

GCSE

Chemistry A

Unit **A172/02**: Modules C4, C5, C6 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2015

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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 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
NBOD	no benefit of doubt
R	reject

	correct response
L1 , L2 , L3	draw attention to particular part of candidate's response
^	information omitted

	indicate uncertainty or ambiguity
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	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		group 1 more reactive down the group / group 1 react faster down the group;(1) group 2 more reactive down the group / group 2 react faster down the group;(1) group 1 more reactive than group 2 / group 1 react faster than group 2;(1)	3	**Accept** for 2 marks 'In BOTH groups the reactivity increases going down the group' **Ignore** comparison between individual metals alone. **Ignore** answers which only mention time taken
	b		TFFF	2	All correct = (2) 2 or 3 correct = (1) 1 correct = 0
				5	

Question			Answer	Marks	Guidance
2	a		Toxic / corrosive / respiratory problems / irritates or damages lungs; gas;	2	**Allow** poisonous **Ignore** harmful / hazardous / dangerous / can kill **Allow** vapour
	b		I_2 + 2KBr; (2) For (1) mark at least one formula correct I_2 / KBr: ;	2	**Allow** BrK Formulae and balancing fully correct = (2)
	c		**[Level 3]** Links two reactions with reactivity and correct observations. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Links a reaction to either the correct observation or to	6	**This question is targeted at grades up to A*** **Indicative scientific points may include:** **Observations** • KF (and KCl) no change / accept yellow or green colour seen (due to chlorine) • KBr orange / brown / yellow-brown / red-brown (**ignore** yellow or red alone) • KI grey colour **accept** brown (**ignore** violet/purple) **Ignore** states, look for colours alone

Question	Answer	Marks	Guidance
	reactivity. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Makes a correct statement about observations, reactions or reactivity. 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)		**QWC is impeded** if other incorrect observations given e.g. precipitates or incorrect colours for elements (ignore bromine red or yellow and iodine violet or purple) **Reactions** • No reaction with KF (and KCl) • Reaction occurs with KBr (may be implied if observations are given) • Reaction occurs with KI (may be implied if observations are given) **Allow Level 1 only** for no reaction between chlorine and potassium chloride **Reactivity** • Cl_2 less reactive than F_2 / cannot displace F_2 • Cl_2 more reactive than Br_2 / can displace Br_2 • Cl_2 more reactive than I_2 / can displace I_2 • Reactivity gets less down the group **QWC is impeded** if 'chlorine' is confused with 'chloride' etc. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**10**	

Question			Answer	Marks	Guidance
3	a		Scientist 2 and scientist 5; (1) Scientist 2 is evaluating/judging/analysing /criticising Mendeleev's work;(1) Scientist 5 is checking/repeating another scientist's work/checking results/look for repeatability; (1)	3	 **Ignore** 'reviewing' (in the Q) **Allow** 'give feedback' **Ignore** 'talking about' 'discussing' (not enough) **Allow** 'do the same experiment' / 'repeat the experiment'
	b		**2 from** Mendeleev: left gaps for undiscovered elements / made predictions about properties; Scientists: Idea of fitting/matching (in the gaps); <u>Idea that properties</u> of new elements agree with or support Mendeleev's predictions;	2	 **Ignore** 'goes in the gaps' (in the Q) **Allow** example of a property that matched
				5	

Question			Answer	Marks	Guidance
4	a		box 2; (1) box 3; (1)	2	
	b		as the RFM increases the BP increases; but this works for 3 gases / N_2 O_2 and CO_2; water does not fit; (because water BP is) too high / has a higher BP (than the others) / has the lowest formula mass has the highest BP;	3	Any 3 **Ignore** 'yes' or 'no' **Ignore** 'correlation' (in the Q)
	c		the relative masses and percentages follow a similar pattern / the bigger the mass the lower the percentage / relative masses and percentages are linked; but one is not a direct result of the other / it is a coincidence / no causal link / no mechanism is known;	2	MP1 refers to the data in the table **Ignore** masses and percentages show a correlation (in the Q) **Accept** one is not caused by the other / both could be caused by another (hidden) factor **Allow** general description of 'cause' for MP2
				7	

Question			Answer	Marks	Guidance
5	a	i	carbon is oxidised **AND** copper (oxide) is reduced;	1	both answers for 1 mark
		ii	carbon dioxide (must be name)	1	**Do not allow** CO_2
	b	i	**Any 3** Cost to company: saves or uses less fuel/electricity/ example of fuel; Environmental: energy comes from fossil fuels / non-renewable or finite fuels; reducing pollutant gases / reduces emissions / reduces named pollutant gas e.g. SOx, NOx, COx; named environmental effect of gases (e.g. acid rain, greenhouse effect/climate change);	3	**Ignore** 'less cost' or 'less pollution' alone. **Ignore** 'uses less power' Ignore 'reduces cost of fuel' (not enough) **Allow**: 'Saving fossil fuels' (2) marks for cost to company and environment **Ignore** 'gives out less gases' or 'less waste' but **allow** 'less *waste* gases'
		ii	any 2 from: jobs/ income; use of metals for products / example of metal use (e.g. cars/fridges etc); idea of local economy; idea of national economy; advantage of large scale: transport links to one area / control of waste is in one area / economy of scale idea / more economic to extract on a large scale / lower energy costs on a large scale / large scale can use continuous not batch processes;	2	 **Ignore** 'to meet demand' or 'need metals' or 'use a lot of metals' alone (not enough) **Allow** 1 mark for 'economy' alone MP5 must be linked to idea of large scale extraction

Question	Answer	Marks	Guidance
c	**[Level 3]** Links **reactivity** with the **method used** and to **energy**. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Makes a link between trends. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Makes a correct statement about the data. 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:** **Level 3: (Links reactivity and method and energy)** • More reactive metals use electrolysis which uses high energy / the more reactive a metal the more energy is needed and electrolysis is used • Less reactive metals use extraction with carbon which uses less energy / the less reactive a metal the less energy is needed and heating with carbon is used **Level 2: (Link between trends)** • Links reactivity to method of extraction • Links reactivity to temperature needed • Links reactivity to energy needed • Links temperature needed to method of extraction • Links temperature to energy • Links method used to energy **Level 1: (data)** • Ca/Mg/Al are most reactive metals • Zn/ Fe/ Pb/Cu are less reactive metals • Ca/Mg/Al need a high temperature (for extraction) • Zn/ Fe/ Pb/Cu need a lower temperature (for extraction) • Ca/Mg/Al use electrolysis • Zn/ Fe/ Pb/Cu use heating with carbon • Mg or Al does not fit the trend **Ignore** references to melting point **Statements** about one metal alone indicate level 1
	Total	**13**	

Question			Answer	Marks	Guidance
6	a		sulfuric acid AND H_2SO_4; (1) water AND H_2O;(1)	2	**Ignore** 'hydrogen sulfate'
	b	i	3.2(g); (1)	**1**	Accept 3.2 alone
		ii	1600 g / 1.6 kg; (2) Uses 1000 in calculation / 1000 g = 1 kg / 1.6 or 1600 with no units or incorrect units (1)	**2**	Answer with units (2) **Allow ecf** for incorrect answer to b (i)
		iii	79.5 g; 159.5 g	2	
		iv	*refers to table*:(relative formula) mass of $CuSO_4$ approximately twice (relative formula) mass of CuO / mass of CuO is half mass of $CuSO_4$ / gives 2:1 ratui idea / gives example masses e.g.8.0g CuO should make 16.0g $CuSO_4$; *refers to graph:* yield of copper sulfate on graph is too high / line on graph too high/ more than double / reads values from graph e.g. 25 g yield compared to 15.95g yield or 8.0 g gives 25 g / calculates ratio or gradient from graph to give approximately 3:1 ratio;	2	**Allow** ecf for incorrect formula masses in iii
				9	

Question			Answer	Marks	Guidance
7	a		H^+	1	
	b		OH^-	1	
	c		more surface area; idea that more collisions occur (between particles of acid and calcium hydroxide); (collisions are….) more frequent/ more per unit time / (collide) more often;	3	 **Allow** 'more chance of collisions' for MP2 only **Ignore** 'faster collisions' **Do not allow** collisions between incorrect particles e.g. atoms / collisions between the same reactant alone 'more frequent collisions' OWTTE (2)
				5	

Question	Answer	Marks	Guidance
8	**Joe's idea**: Gp1 and Gp2 do not work **Eve's idea**: depends on + ion **Jay's idea**: depends on – ion **[Level 3]** Correctly states that the ideas of Joe and Eve are correct and Jay is incorrect **and** gives reasons for two people **and** identifies control for Joe Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Correctly states that the ideas of Joe and Eve are correct and Jay is incorrect **and** gives a reasons for one person.	6	**This question is targeted at grades up to A*** **Indicative scientific points may include:** **Level 3: Control** • Joe: compares group 1 and group 2 to no catalyst /times or rate the same as no catalyst **Ideas and reasons (Level 1, level 2, level 3)** **Joe:** • Joe's idea is correct/don't work at catalysts • Group 1 and group 2 reaction times all the same/take 45s / gives same rate / does not speed up • Na^+/K^+ and Mg^{2+} all the same / take 45/46s (accept that Mg^{2+} is slower at 46s idea).

Question	Answer	Marks	Guidance
	Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Correctly states that the ideas of Joe and Eve are correct and Jay is incorrect OR correctly states whether one person is correct **and** gives a reason. 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)		**Eve** • Eve's idea is correct / iron acts as a catalyst • Using Fe^{2+} reduces reaction time / gives faster reaction **Jay** • Jay's idea is incorrect /chloride and nitrate don't work as catalysts • chlorides the same as nitrates **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**6**	

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