OCR
Oxford Cambridge and RSA

GCSE

Chemistry A / Additional Science A

Unit **A172/01**: Modules C4, C5, C6 (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for June 2017

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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

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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 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)	(i)	Na_2SO_4	1	
		(ii)	$CaCl_2$	1	
	(b)		42 ; 111 ;	2	
	(c)		*Any two from:* (ions in solids) are arranged in a regular fashion / (ions in seawater)are random; (ions in solids)are close together / (ions in seawater) are far apart; (ions in solids) only move around fixed position / (ions in seawater) move freely/over each other; any comparison of arrangement or movement between seawater and solid;	3	 **Allow** (ions in seawater) are scattered. **Allow** water separates the ions (in seawater) **Allow** they don't move in solids **Ignore** speed of movement e.g. ions in solid move more slowly/ ions are free. **Allow** statement about solid and solution from the same MP as a comparison. **Ignore** comparison of presence of water molecules.
	(d)		idea of less mining / gives disadvantage of mining / examples of spoiling of land; examples of spoiling of marine environment / damage to marine life;	2	 **Ignore** unqualified references to pollution (air pollution etc…)/the environment. **Allow** discussion of fossil fuel use for advantage or disadvantage e.g. advantage is less fossil fuels because less machinery / disadvantage is more fossil fuels used for extraction from seawater.
			Total	9	

Question	Answer	Marks	Guidance
2	**[Level 3]** Identifies why elements are in group 1 **and** states changes down the group. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** States changes down the group **or** identifies why elements are in group 1 with one statement about one change down the group. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Makes statements to compare the atoms **OR** States a change down the group. 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:** **Identifies why in Group** • group 1 elements all have one electron in outer shell **Changes down the group** • number of electron shells increases (down the group) • number of protons increase (down the group) • number of neutrons increase (down the group) • number of electrons increase (down the group) • atoms get larger (down the group) **Level 1 only statements** • number of protons is different • number of neutrons is different • number of electrons / shells is different • same number of electrons in inner/outer shell • (all have) one more neutron than proton **Ignore** references to changes in properties/reactivity down the group/quoted electron arrangements without description of change. **Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.**
		6	

Question			Answer	Marks	Guidance
3	(a)		*Any 2 from:* Reaction is displacement ; bromine reacts with (potassium) <u>iodide</u> / bromine gains electrons (from iodide) / bromine reacts to form (potassium) bromide ; iodine forms ;	2	Accept 'replacement' or 'takes the place of' **Do not allow** bromine gains electrons from potassium '**Bromine displaces iodine' is (2 marks)** for MP1 and MP3 **Accept** correct formulae for names of substances
	(b)		glowing iron / solid/fumes formed; (1) faster/more vigorous reaction (with chlorine); (1)	2	**Accept** 'iron burns' **Ignore** colour of solid/fumes **Allow** bigger reaction with chlorine Iron burns more brightly/brighter (with chlorine) = 2 marks.
	(c)		**word** / **meaning** element → all of the atoms in bromine are the same bromine is in group 7 diatomic → bromine is a gas every molecule of bromine contains two atoms	2	
			Total	6	

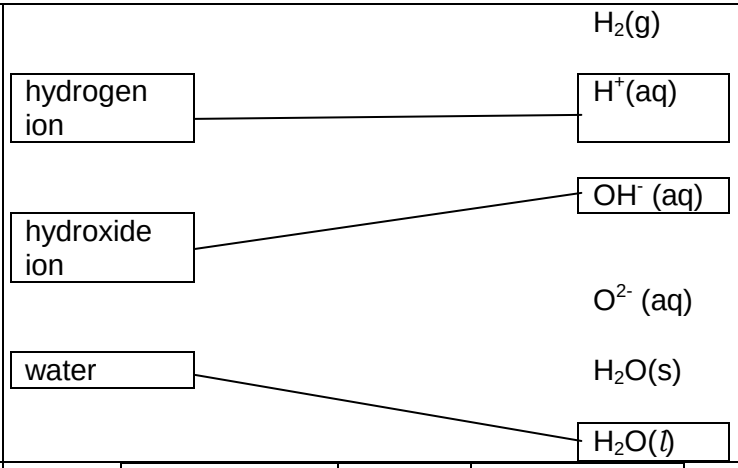
Question			Answer	Marks	Guidance
4	(a)		They are all solids. ☐ They all conduct electricity. ☐ They are all non-metals. ✓ They all react with water. ☐	1	
	(b)	(i)	(12+16)/2 ; (1) = 14 ; (1)	2	14 alone (2)
		(ii)	14	1	
		(iii)	(yes because) the two values agree/are the same.	1	**Allow** values are similar/close **Allow** ecf on incorrect (i) and/or (ii)
	(c)		**group** / **triad** 2 — calcium Ca; strontium Sr; barium Ba 5 — sulfur S; selenium Se; tellurium Te 6 — nitrogen N; phosphorus P; arsenic As	2	All correct (2) 1 or two correct (1)
	(d)		data about some elements did not fit his idea ✓ the Periodic Table had not yet been developed ☐ other scientists had better ideas about organising elements ✓ some elements had not been discovered ☐	2	
			Total	9	

Question	Answer	Marks	Guidance
5 a	**[Level 3]** States that sodium cannot be identified **and** gives correct test solutions for specified ions linked to correct observations. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** States that sodium cannot be identified **and** gives a correct test solution for a specified ion linked to a correct observation. **OR** States that sodium cannot be identified **and** gives correct test solutions for specified ions. **OR** Gives correct test solutions for specified ions linked to correct observations Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Identifies that sodium cannot be identified **OR** gives a correct test solution for a specified ion linked to a correct observation. **OR** Gives correct test solutions for specified ions. 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:** • sodium cannot be identified **Test solutions and observations:** • Use dilute sodium hydroxide • calcium gives white precipitate (which does not dissolve in excess) • (dilute acid plus) silver nitrate • white precipitate shows chloride • (dilute acid plus) barium nitrate/chloride • white precipitate shows sulfate. **Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.**

Question			Answer	Marks	Guidance
5	b		flame tests ✓ crystallisation evaporation looking at line spectra ✓ filtration	2	
				8	

Question			Answer	Marks	Guidance
6	(a)	(i)	*Any three from:* hydrochloric and/or nitric have one H atom in the formula /sulfuric acid has more (two) H atoms/ions in the formula; acids with one hydrogen (atom/ion) give same temperature/change)/5 (^{o}C) / **both** hydrochloric and nitric give the same temperature/change/5 (^{o}C); sulfuric acid / the acid with 2 hydrogens gives a higher temperature/change/9.5(^{o}C); sulfuric acid gives (almost) double the temperature/change / the acid with 2 hydrogen (atoms/ions) gives (almost) double the temperature/change;	3	If no other marks are given **Allow (1) mark** only for 'the more hydrogen (ions) the greater the temperature change (increase)' **Allow** hydrochloric and/or nitric have fewer/less hydrogen atoms/ions in the formula ; MP4 includes MP3 and so scores (2)
		(ii)	(repeat with) the same acids; (repeat with) more/different acids; (repeat with) acids with more than 2 H atoms;	3	**Allow** repeat experiment **Ignore** (repeat with) all acids. MP3 includes MP2 and so scores 2 marks. **Ignore** references to strength of acids.
	(b)		neutralisation ✓ titration analysis exothermic ✓ corrosive	2	

(c)



2 All correct (2)
1 or 2 correct (1)

(d)

	name	formula	elements in formula
acid used	sulfuric acid	H_2SO_4	hydrogen sulfur oxygen
alkali used	sodium hydroxide	NaOH	sodium **oxygen** **hydrogen ; (1)**
salt formed	**sodium sulfate ; (1)**	Na_2SO_4	**sodium** **sulfur** **oxygen ; (1)**

3

Total **13**

Question			Answer	Marks	Guidance
7	(a)	(i)	Any 2 from: volume/amount/type of acid ; mass/amount/volume/size of pieces/surface area of zinc; temperature ;	2	 **Ignore** 'concentration of zinc' **Accept**: use the same (type of) catalyst / mass/amount/volume/size of pieces/surface area of catalyst
		(ii)	hydrogen	1	

Question	Answer	Marks	Guidance
7 b	**[Level 3]** Makes correct conclusions about the effect of concentration **and** a catalyst on rate **and** supports both conclusions with data. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Makes correct conclusions about the effect of both concentration **and** a catalyst on rate. **OR** Makes a correct conclusion about the effect of either concentration **or** a catalyst on rate **and** supports conclusion with data. **OR** Makes correct statements about the effect of concentration **and** catalyst on volume of gas produced **and** supports statements with data. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Makes a correct statement about the results. 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/D** **Conclusions about rate** • higher concentration makes reaction faster / speeds it up /faster rate • using a catalyst makes reaction faster / speeds it up / faster rate **Data supporting conclusions/statements** • Quotes two volumes both with catalyst linked to concentration change. • Quotes two volumes both without catalyst linked to concentration change. • Quotes two volumes at same concentration linked to catalyst • Volume doubles with a catalyst (this is also a statement) **Statements about the results** • at higher concentrations higher volume/more gas given off. • when a catalyst is used higher volume/more gas is given off • bigger volume means faster rate **Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.**
	Total	**9**	

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