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 2014

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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
BP	Blank Page – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
/	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:

	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
^	information omitted
CON	contradiction

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

ADDITIONAL OBJECTS: You **must** assess and annotate the additional objects for each script you mark. Where credit is awarded, appropriate annotation must be used. If no credit is to be awarded for the additional object, please use annotation as agreed at the SSU.

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. 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**

d. 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		all produce hydrogen; (1) and an alkaline solution / make an alkali / make a hydroxide; (1)	2	**Ignore** makes a gas/bubbles/salt **Accept** 'it is an alkali'
	b		Triad D (carbon, nitrogen, oxygen); (1) In the (same) period / idea of across a row / different number of outer shell electrons / gives correct groups for at least two elements e.g. carbon Gp 4, nitrogen Gp 5, oxygen Gp 6; (1)	2	 **Ignore** 'different groups' **Ignore** different number of electrons alone

Question			Answer	Marks	Guidance
	c i		**Any 2 from** check (original) data / check RAMs; AW check/repeat/work out calculation or mean; AW peer review / discuss / decide if they agree/disagree AW test predictions / see if his ideas work for other elements; AW	2	**Ignore** 'evaluate ideas' in the Q **Allow** repeating experiment idea for checking data. **Allow** attempt to check calculation using numbers in Q **Allow** 1 mark for idea of 'checking' unqualified
	c	ii	average mass = 130 /130.25 / difference between RAM of silver and copper is 44.5 / difference between RAM of silver and gold is 89; (1) which is different to 108 / different to (RAM of) silver / mean is too high / RAM of silver not in the middle idea / differences in RAM not equal idea; (1)	2	Answer must refer to silver/108/middle one for second mark **Allow** second mark ecf on incorrect calculation **Allow** 'it is 22/22.25 too high' for (2)
			Total	**8**	

Question			Answer	Marks	Guidance
2	a		**Any 2 from** the number of electrons is the same as the number of (positive) charges on the ion / the more electrons the higher the charge; the number of electrons is the same as the number of chlorine (atoms) in the formula / the more electrons the higher the number of chlorines in the formula; the (positive) charge on the ion is the same as the number of chlorine (atoms) in the formula;	2	**Accept** Number of electrons=number of electrons in the outer shell Answer must compare numbers in general or use examples of elements with different numbers of electrons e.g. 'Li has one electron and has a charge of +1' alone = 0 **Allow** 'number of chlorides'
	b		KCl (1) $GaCl_3$ (1)	2	Do not accept incorrect case in symbol e.g. GA/GA or CL
	c		Fe^{3+}/Fe^{+3} (1) Cl^- (1)	2	 **Accept** $3Cl^-$
			Total	**6**	

Question			Answer	Marks	Guidance
3			**[Level 3]** Identifies trends in both radius and energy **AND** links electron shells to one of the trends. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Identifies both trends (atomic radii and energy needed to remove an electron) **AND** describes the electron arrangement in two or more atoms. **OR** Identifies one trend and gives a level 3 link between electron shells and the trend. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Describes at least one trend in the data **OR** describes the electron arrangement in two or more atoms. 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:** **Links electron shells to trends in radius/energy (level 3)** • more (electron) shells causes a larger atomic radius / idea that the atom is larger if it has more shells • statement of idea that outer shell electrons are further away from nucleus in bigger atoms. • More electron shells need less energy to remove electron/easier to remove an electron • More electron shells lead to more shielding. • Further from nucleus, less energy needed to remove electron/easier to remove an electron **Describes electron arrangement (level 2 and 1)** • Li 2,1. Na 2,8,1 K 2,8,8,1 /draws correct diagrams • identifies the number of electron shells in at least two atoms • identifies a trend in electron shells/ down the group there are more shells / atoms with more electrons have more electron shells. **Describes the trends in the data (all levels)** • atomic radius increases with increasing electron number or down the group • energy needed to remove electron decreases with increasing electron number or down the group • larger radius, less energy needed to remove electron or larger radius, easier to remove an electron **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**6**	

Question			Answer	Marks	Guidance
4	ai		TFFTT	2	All correct = (2) 3/4 correct = (1)
	ii		**Any 2 from** Gain electrons; 3 electrons; to form (aluminium) <u>atoms</u>;	2	MP1 and MP2 can be scored from a correct equation ($Al^{3+} + 3e^- \rightarrow Al$) **Ignore** equation if it is incorrect **Allow** 'lose 3 electrons' for 1 mark maximum **Ignore** 'forms Al' alone
	b	i	$2CuO + C \rightarrow CO_2 + 2Cu$ correct formula (1) balanced (1)	2	Cu_2 in equation = 0 **Ignore** state symbols
		ii	taking away oxygen / gain of electrons;	1	
		iii	aluminium is very reactive / more reactive than carbon ORA;	1	**Ignore** 'aluminium is more reactive than copper' **Ignore** 'carbon is not strong enough'
			Total	**8**	

Question			Answer	Marks	Guidance
5	a		**[Level 3]** Processes data about supply or demand and links data about both to a problem. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Identifies a problem and uses data about both supply and demand OR identifies a problem linked to processed data about supply or demand. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Identifies a problem and uses data about supply or demand. 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:** **Problems** • idea that copper supplies will run out in the future/are finite/limited • Supply cannot meet demand **Data about supply and demand** Demand: • demand for copper is rising • Quotes value(s) from demand graph Supply: • Recycling/scrap can only supply 50% of demand • Quotes value(s) from supply table • only four countries have (large) copper supplies. **Processed data** • between 2010 and 2030 copper demand is expected to double. • Demand for copper is rising faster (over time) • Attempts to estimate number of years' supply. • uses values from the supply table to compare to the annual demand. • Total supply from 4 countries is 289 million tonnes • discusses a shortfall between demand and supply using data from both the table and the graph **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

Question			Answer	Marks	Guidance
	b		copper ions; (1) electrons; (1)	2	
	c		particles in copper can slide over each other	1	
	d		Many metal hydroxides are insoluble; (1) Precipitates of metal compounds have characteristics colours; (1)	2	
			Total	**11**	

Question			Answer	Marks	Guidance
6	a		**[Level 3]** Makes statements about the trend on the graph and explains the trend in terms of collision theory. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Makes statements about the trend on the graph and makes a statement about collision theory **OR** makes one statement about the trend with a level 3 explanation in terms of collision theory. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Makes statements about the trend on the graph. 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** **Explains trend in terms of collision theory (level 3)** • Concentration of acid decreases/acid is used up therefore fewer collisions • acid particles are further apart therefore fewer collisions • surface area of zinc decreases as zinc is used up so fewer collisions. • Less frequent (rate of) collisions leads to lower rate of reaction **Collision theory (level 2)** • particles must collide to react • more (chance of successful) collisions= faster reaction • idea that when collisions stop reaction stops. • More concentrated acid contains more particles (per unit volume) • Higher surface area leads to more collisions **Trend on the graph (levels 1, 2 and 3)** • reaction is fastest at the start (at A) • reaction slows down (at B) • then stops / fully reacted / reaction over idea (at C) • The mass falls / flask gets lighter If answer includes incorrect or irrelevant points (e.g. rate increases at start / discussion of effect of energy or temperature / rate at C is steady) then consider quality of communication to be impeded at levels 2 and 3 only. **Indicative scientific points may include:** **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

Question			Answer	Marks	Guidance
	b		zinc chloride	1	**Allow** $ZnCl_2$ **Ignore** incorrect formula if name is correct. **Allow** zinc chloride and hydrogen(1) **Do not allow** if other incorrect additional products are named.
	c		Repeat (same) experiment; (1) add copper/catalyst; (1) look for a faster reaction/higher rate; (1)	3	**Allow** 'do it again' **Allow** shorter time
	d		TFTT	1	
			Total	**11**	

Question			Answer	Marks	Guidance
7	a		hydrochloric acid: H^+ and Cl^- (1) sulfuric acid : H^+ and SO_4^{2-} (1)	2	**ignore** OH^- / HCl (in LHS box) / H_2SO_4 (in RHS box)
	b	i	Test A and B;(1) (both) give a low value for pH / pH below 7; (1) (both) react with magnesium ribbon / ribbon 'disappears'/ fizz / see a gas; (1)	3	 **Accept** 'hydrogen forms'
		ii	(Test C and D) because (test C silver nitrate) white precipitate (with HCl or chloride); (1) (test D barium chloride) white precipitate (with H_2SO_4 or sulfate); (1) no precipitate with 'other' acid stated for at least one of the tests / use of the word 'only'; (1)	3	 e.g. 'test C gives white ppt with HCl only' = (2)
	c		sodium chloride AND NaCl; sodium sulfate AND Na_2SO_4;	2	**Allow** (1) if both names correct OR if both formulae are correct
			Total	**10**	

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