

Chemistry B

General Certificate of Secondary Education

Unit **B742/01**: Modules C4, C5, C6 (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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1. Annotations

Annotation	Meaning
	correct response
	incorrect response
	benefit of the doubt
	benefit of the doubt <u>not</u> given
	error carried forward
	information omitted
	ignore
	reject
	contradiction
	Level 1
	Level 2
	Level 3

2. **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.

3. Subject-specific Marking Instructions

Abbreviations, annotations and conventions used in the detailed Mark Scheme.

- / = alternative and acceptable answers for the same marking point
- (1) = separates marking points
- allow** = answers that can be accepted
- not** = answers which are not worthy of credit
- reject** = answers which are not worthy of credit
- ignore** = statements which are irrelevant
- () = words which are not essential to gain credit
- = underlined words must be present in answer to score a mark (although not correctly spelt unless otherwise stated)
- ecf** = error carried forward
- AW** = alternative wording
- ora** = or reverse argument

Question		Answer	Marks	Guidance
1	(a)	17 (1)	1	
	(b)	12 (1)	1	
	(c)	Mg and Ca / He and Ne(1)	1	both needed allow MG and CA / HE and NE allow magnesium and calcium / helium and neon answer must be in table
	(d)	O and Ne / Mg and Cl(1)	1	both needed allow NE / MG and CL / Cl ₂ allow oxygen / O ₂ and neon / magnesium and chlorine answer must be in table
		Total	4	

Question		Answer	Marks	Guidance
2	(a)	any two from: so results can be replicated (1) so further evidence can be collected (1) idea of peer review (1) idea of gaining credit for (1)	2	allow so the theory can be tested allow so the theory can be developed allow idea that theory can be proved right or wrong if no other mark awarded award 1 mark for idea of telling others (scientists) what they have found out (1)
	(b)	any one from: in Rutherford's theory the atom can be split / Rutherford's theory does not have solid atoms / Rutherford's theory has atoms of mostly space (1) in Dalton's theory atoms could not be split (1)	1	allow presence of nucleus or electrons in Rutherford's theory / smaller particles present allow Dalton was unaware that electrons / nucleus exist
	(c)	negative (1)	1	allow minus / -1
		Total	4	

Question		Answer	Marks	Guidance
3	(a)	any two from: because it reacts with water (1) because it reacts with oxygen / because it reacts with air (1) because it is a reactive metal (1)	2	allow so that it does not react / prevent contact with oxygen / air and water (2) allow it reacts with moist air or damp air (2) ignore prevents corrosion / rusting
	(b)	Level 3 (5–6 marks) Candidates recall word equation or an unbalanced symbol equation for the reaction between either caesium or lithium and water. Candidate applies knowledge of the reaction of alkali metals to predict observations and names of products formed in the reaction between caesium and water, including the idea that the reaction with caesium is faster. Quality of written communication does not impede communication of the science at this level. Level 2 (3–4 marks) Candidate applies knowledge of the reaction of alkali metals to predict an observation and gives the name or formulae of a product formed in the reaction between caesium and water. Quality of written communication partly impedes communication of the science at this level. OR Candidates recall word equation or an unbalanced symbol equation for the reaction between either caesium or lithium and water. Level 1 (1–2 marks) Candidate applies knowledge of the reaction of alkali metals to make a simple observation OR names a product formed in the reaction of caesium with water. Quality of written communication impedes communication of the science at this level. Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.	6	This question is targeted at grades up to C Indicative Scientific points may include <ul style="list-style-type: none"> caesium + water → caesium hydroxide + hydrogen $\text{Cs} + \text{H}_2\text{O} \rightarrow \text{CsOH} + \text{H}_2$ (need not be balanced) lithium + water → lithium hydroxide + hydrogen $\text{Li} + \text{H}_2\text{O} \rightarrow \text{LiOH} + \text{H}_2$ (need not be balanced). Word equations <ul style="list-style-type: none"> hydrogen made caesium hydroxide made bubbles floats and moves on the surface gives a flame gets smaller and forms a colourless solution faster reaction than with lithium / extremely rapid reaction caesium is more reactive than lithium reaction is more explosive.
		Total	8	

Question		Answer	Marks	Guidance
4	(a)	<p>yes as the temperature increases the mass decreases / no because from 500 the mass no longer decreases (1)</p> <p>idea that the lower the mass the more carbon dioxide is made / correct link between decrease in mass and the mass of carbon dioxide being made (1)</p>	2	no mark for yes or no on its own
	(b)	<p>lime water / calcium hydroxide (solution) (1)</p> <p>goes milky / gives a white precipitate (1)</p>	2	allow $\text{Ca}(\text{OH})_2$ allow goes white / misty / cloudy / creamy
		Total 4		

Question		Answer	Marks	Guidance
5	(a)	<p>Ti / V / Cr (1)</p> <p>have melting points above melting point of iron (1)</p>	2	allow titanium / vanadium / chromium allow vanadium has the highest melting point (2)
	(b)	K (1)	1	allow potassium
	(c)	<p>any two from:</p> <p>high boiling point (1)</p> <p>(good) thermal conductor (1)</p> <p>(good) electrical conductor (1)</p> <p>high density (1)</p> <p>malleable / flexible (1)</p> <p>ductile (1)</p> <p>lustrous (1)</p> <p>hard (1)</p> <p>high tensile strength (1)</p> <p>sonorous (1)</p> <p>have basic oxides (1)</p> <p>form positive ions (1)</p> <p>form ionic compounds (1)</p>	2	ignore just a good conductor ignore just dense allow shiny allow strong allow often react with acids to give hydrogen
		Total 5		

Question		Answer	Marks	Guidance
6	(a)	suitable method of collecting gas – graduated gas syringe, measuring cylinder, burette (2)	2	allow one mark for collection using apparatus that was not graduated but the method must work
	(b) (i)	38 – 41 (seconds) (1)	1	
	(ii)	acid or magnesium runs out (1)	1	allow reactant(s) run out / used up ignore magnesium dissolved
		Total	4	

Question		Answer	Marks	Guidance															
7	(a)	3 rd row – 0.51 (1) 4 th row – 0.28 (1)	2	<table border="1"> <thead> <tr> <th>mass of magnesium in g</th> <th>mass of oxygen used in g</th> <th>mass of magnesium oxide made in g</th> </tr> </thead> <tbody> <tr> <td>0.10</td> <td>0.07</td> <td>0.17</td> </tr> <tr> <td>0.20</td> <td>0.14</td> <td>0.34</td> </tr> <tr> <td>0.30</td> <td>0.21</td> <td>0.51</td> </tr> <tr> <td>0.40</td> <td>0.28</td> <td>0.68</td> </tr> </tbody> </table>	mass of magnesium in g	mass of oxygen used in g	mass of magnesium oxide made in g	0.10	0.07	0.17	0.20	0.14	0.34	0.30	0.21	0.51	0.40	0.28	0.68
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	(b)	1.0 (g) (1) 1.7g magnesium is 10x 0.17 so amount of Mg is 0.1×10 (1)	2	allow 1g explanation must be given for two marks															
	(c)	40 (g/mol) (1)	1	ignore any unit given															
		Total	5																

Question		Answer	Marks	Guidance
8	(a)	red / pink (1)	1	
	(b)	add alkali / sodium hydroxide (from the burette) to acid (1) (sodium hydroxide is added) until end point is reached (1) add indicator or named indicator (1)	3	allow or until a colour change is seen
	(c) (i)	$\frac{22.1 + 22.3 + 22.2}{3}$ (1) or 22.2 (1)	1	
	(ii)	titration 1 is not consistent / only consistently close readings should be included / all the other volumes are close to one another / all the other volumes are within 0.2 cm ³ (1)	1	allow titration 1 is a rough titration / titration 1 is inaccurate / it is a practice titration allow titration 1 is an outlier or anomaly allow it is a very different from the other values e.g. it is (at least) 0.5 cm ³ different ignore it does not follow the pattern
		Total	6	

Question		Answer	Marks	Guidance
9		<p>Level 3 (5–6 marks) Includes an explanation of both a reversible reaction and an equilibrium and correctly describes the effect of pressure and temperature on the position of equilibrium. Quality of written communication does not impede communication of the science at this level.</p> <p>Level 2 (3–4 marks) Includes an explanation of either a reversible reaction or an equilibrium and correctly describes the effect of pressure or temperature on the position of equilibrium OR includes an explanation of both a reversible reaction and an equilibrium OR correctly describes the effect of pressure and temperature on the position of equilibrium Quality of written communication partly impedes communication of the science at this level.</p> <p>Level 1 (1–2 marks) Explains what is meant by either a reversible reaction or an equilibrium OR includes one correct description of the effect of either pressure or temperature on the position of equilibrium. 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 grade C.</p> <p>Relevant points include:</p> <ul style="list-style-type: none"> • idea that reversible reactions can proceed in both directions / go forwards and backwards • idea that, at equilibrium, rate of forward reaction equals the rate of the backward reaction • idea that, at equilibrium, concentrations of reactants and products do not change • as the pressure increases the position of equilibrium moves to the right or concentration of products increases or vice versa • as the temperature increases the position of equilibrium moves to the left or the concentration of reactants increases or vice versa. • increase temperature less ammonia • increase pressure more ammonia
			Total 6	

Question		Answer	Marks	Guidance
10	(a)	LOOK FOR ANSWER FIRST OF ALL IF concentration = 27.4 (%) OR 27(%) AWARD 2 MARKS $\frac{19.2}{70} \times 100 \text{ (1)}$	2	
	(b)	fish (1) then any one from: least energy (1) least fat (1) least sodium (1) least carbohydrate (1)	2	allow curry because it contains most / a lot of protein (1) allow low for least allow calories for energy
		Total	4	

Question		Answer	Marks	Guidance
11	(a) (i)	chlorine (1) potassium (1)	2	allow Cl_2 / Cl / CL not chloride allow K
	(ii)	solid sodium chloride has ions in fixed positions / ions do not move in a solid (1) liquid sodium chloride has ions that move (1)	2	Ignore electrons cannot move in a solid allow solid has no free ions allow liquid sodium chloride has free ions NOT electrons can move in a liquid if no other mark scored 1 mark for particles cannot move in a solid but can move in a liquid / liquid has mobile charge carriers but solid does not for one mark

Question		Answer	Marks	Guidance
(b)		<p>experiments 1 and 3 show that as time doubles mass (of copper made) doubles (1)</p> <p>experiments 3 and 4 show that as the current quadruples, the mass also quadruples (1)</p> <p>OR</p> <p>experiments 1 and 2 show that as current doubles mass (of copper made) doubles (1)</p>	2	<p>allow reference to the correct data in the table to identify which experiments they are using</p> <p>allow when the time doubles and the current stays the same the mass doubles</p> <p>allow when the current doubles and the time stays the same the mass doubles</p> <p>allow if no other marks awarded then as time and current increase the mass (of copper) increases for one mark</p>
		Total		6

Question		Answer	Marks	Guidance
12	(a)	any one from: contains oxygen (1) has other elements other than hydrogen or carbon / has atoms besides hydrogen and carbon (1) does not contain just carbon and hydrogen (1)	1	allow has O in the formula allow hydrocarbons contain hydrogen and carbon only
	(b)	hydration (1)	1	allow other ways of indicating correct response eg ringing or ticking the correct answer but answer line takes precedence
	(c)	Level 3 (5–6 marks) Describes how ethanol is made from glucose including how ethanol is separated from the reaction mixture. Quality of written communication does not impede communication of the science at this level. Level 2 (3–4 marks) States that fermentation needs yeast or enzymes and describe a condition needed for fermentation OR describe partly how ethanol is made from glucose including mention of use of yeast and distillation Quality of written communication partly impedes communication of the science at this level. Level 1 (1–2 marks) States that fermentation needs yeast or enzymes or catalyst. OR gives one condition Quality of written communication impedes communication of the science at this level. Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.	6	This question is targeted at grades up to C Indicative scientific points at Level 3 should include: <ul style="list-style-type: none"> use of distillation to obtain pure alcohol. Indicative scientific points at Levels 1 and 2 may include: <ul style="list-style-type: none"> water required temperature 25 – 50°C / warm / body temperature absence of oxygen reaction catalysed by (enzymes) in yeast. Indicative scientific points at Level 1 may include: <ul style="list-style-type: none"> yeast needed enzyme such as zymase needed. any condition from the list above distillation to get pure alcohol
			Total	8

Question		Answer	Marks	Guidance
13	(a)	zinc + copper sulfate → copper + zinc sulfate (1)	1	allow = instead of → order of reactants and products does not matter not and or & in equation ignore roman numerals in formula allow correct symbol equation even if not balanced $Zn + CuSO_4 \rightarrow Cu + ZnSO_4$
	(b)	correct order (1) (magnesium) zinc iron copper	1	allow correct symbols Zn Fe Cu
	(c)	silver is deposited on the copper (strip) (1) because copper is more reactive than silver / silver is less reactive than copper / copper is higher in the reactivity series / silver is lower in reactivity series (1)	2	allow solution goes blue / copper turns black allow copper displaces silver / copper nitrate formed
		Total	4	

Question		Answer	Marks	Guidance
14	(a) (i)	B (1)	1	allow other ways of indicating correct response eg ringing or ticking the correct answer
	(ii)	water sample A has lots of lather / no scum (1)	1	
	(b)	any two from distilling water (1) use of ion exchange (column) (1) adding washing soda / Calgon (1) boiling (1)	2	ignore heat the water but allow heat water to decompose calcium / magnesium hydrogen carbonate allow removing the (soluble) calcium / magnesium ions ignore use of water softener / brita or other named filter
		Total	4	

Question		Answer	Marks	Guidance
15	(a)	any two from (increased) risk of (sun)burn (1) accelerated ageing of skin (1) skin cancer (1) (increased) risk of cataracts (1)	2	Ignore just cancer allow damage to eye, ignore blindness
	(b)	CCl ₃ F has 5 atoms and C ₂ HF ₅ has 8 atoms (1)	1	allow C ₂ HF ₅ has three more atoms / ora
		Total	3	

Question		Answer	Marks	Guidance
16	(a)	(concentration) increases (1) reaches a maximum / later on it decreases (1)	2	
	(b)	any year in the range 1990–1994 (1) because this is the maximum / this is where the concentration stops increasing / this is where the concentration starts decreasing (1)	2	allow a year before 1990 if the explanation refers to the idea of a time-lag between the ban and when it has an effect give credit for correct response to second marking point if year range extends just beyond 1994, eg 1995 / 1996
	(c)	LOOK FOR ANSWER FIRST OF ALL IF age = 43 years AWARD 2 MARKS 1970 is the year having 2.0 (1) so age is 43 years (1)	2	 allow ecf from wrong year from graph ie 2013 – year
	(d)	LOOK FOR ANSWER FIRST OF ALL IF year = 2078 AWARD 2 MARKS in 2003 it is 8.0 so at 50% it will be 4.0 (1) 2078 (1)	2	look for working out on the graph allow ecf from incorrect 50% value
	(e)	Concentration of CFC12 is (always) smaller than CFC11 (1)	1	assume unqualified answers refer to CFC12 allow ora if specified
	(f)	as ozone decreases CFC increases / ora (1)	1	allow when CFC concentration is high ozone is low / ora allow when one goes up the other goes down
		Total	10	

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