

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the May/June 2015 series

0620 CHEMISTRY

0620/33

Paper 3 (Extended Theory), maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Abbreviations used in the Mark Scheme

- ; separates marking points
- / separates alternatives within a marking point
- **OR** gives alternative marking point
- **R** reject
- **I** ignore mark as if this material was not present
- **A** accept (a less than ideal answer which should be marked correct)
- **COND** indicates mark is conditional on previous marking point
- owtte or words to that effect (accept other ways of expressing the same idea)
- max indicates the maximum number of marks that can be awarded
- ecf credit a correct statement that follows a previous wrong response
- () the word / phrase in brackets is not required, but sets the context
- ora or reverse argument

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Question	Answer	Marks
1(a)(i)	AlF ₃ ;	1
1(a)(ii)	As ₂ O ₃ ;	1
1(a)(iii)	SiBr ₄ ;	1
1(b)(i)	P ³⁻ ;	1
1(b)(ii)	Ba ²⁺ ;	1
1(b)(iii)	Fr ⁺ ;	1
1(c)	M1 2 double bonds, one between each O and the C atom; M2 each O has 8 outer electrons; M3 each C has 8 outer electrons;	3

Question	Answer	Marks
2(a)	carbon monoxide;	1
2(b)	sodium oxide;	1
2(c)	sulfur dioxide;	1
2(d)	zinc oxide OR aluminium oxide;	1
2(e)	silicon(IV) oxide;	1
2(f)	sulfur dioxide;	1

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Question	Answer	Marks
3(a)	carbon dioxide escapes / leaves / lost / released OR not a closed system;	1
3(b)	CaO + H ₂ O → Ca(OH) ₂ reactants; product;	2
3(c)	M1 number of moles of CaCO ₃ = (12.5 / 100 =) 0.125 or 125000 OR 56 / 100 = 0.56; M2 mass calcium oxide = (0.125 × 56) = 7 (tonnes) OR 0.56 × 12.5 = 7;	2
3(d)(i)	<i>Any two from:</i> does not wash away / insoluble / lasts a long time; does not increase pH above 7 / neutral / has pH 7; naturally occurring / does not need to be processed;	2
3(d)(ii)	<i>Any three from:</i> (flue gas contains) sulfur dioxide; flue gas / sulfur dioxide is acidic; calcium carbonate reacts with sulfur dioxide; to make a salt / calcium sulfite OR neutralisation;	3
3(d)(iii)	making steel or iron / in a <u>blast</u> furnace / toothpaste / (making) glass / building / (making) cement / treating acidic river or lakes / chalk;	1

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Question	Answer	Marks
4(a)(i)	<i>Any one fossil fuel from:</i> crude oil / petroleum / natural gas / methane / petrol / gasoline / kerosene / paraffin / diesel (oil) / gas oil / fuel oil / refinery gas / LPG / propane / butane;	1
4(a)(ii)	(burn to) release energy; take a long time to form (from organic material);	2
4(b)(i)	oxygen / air and sulfur (from fuel) react; (forms) sulfur (di)oxide; (sulfur dioxide) reacts with oxygen / air and water (to form sulfuric acid) OR sulfur trioxide reacts with water (to form sulfuric acid) OR sulfurous acid reacts with oxygen (to form sulfuric acid);	3
4(b)(ii)	oxygen and nitrogen react; making oxides of nitrogen; (oxides of nitrogen) react with water (making nitric acid);	3
4(b)(iii)	add sodium hydroxide (solution) and aluminium; (warm) and ammonia made;	2

Page 6	Mark Scheme	Syllabus	Paper
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Question	Answer	Marks
4(b)(iv)	<p>M1 measure pH/describe how to measure pH (such as use universal indicator); M2 lower pH greater concentration of H⁺;</p> <p>OR</p> <p>M1 add Ca, Mg, Zn, Fe; M2 faster reaction greater concentration of H⁺ /faster bubbles or more hydrogen (in same time);</p> <p>OR</p> <p>M1 rate of reaction with (metal) carbonate; M2 faster reaction greater concentration of H⁺ /faster bubbles or more carbon dioxide (in same time);</p> <p>OR</p> <p>M1 electrical conductivity; M2 greater conductivity greater concentration of H⁺;</p> <p>OR</p> <p>M1 titrate with (named) alkali; M2 correct result;</p>	2

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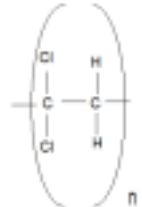
Question	Answer	Marks
5(a)	$(\text{CuCO}_3 \rightarrow) \text{CuO} + \text{CO}_2;$ $(\text{Cu}(\text{OH})_2 \rightarrow) \text{CuO} + \text{H}_2\text{O};$ $(2\text{Cu}(\text{NO}_3)_2 \rightarrow) 2\text{CuO} + (4\text{NO}_2) + \text{O}_2$ species; balancing;	4
5(b)(i)	(black to) pink/brown/orange;	1
5(b)(ii)	(hot) copper reacts/is oxidised; with oxygen/air;	2
5(b)(iii)	carbon monoxide/ammonia/methane;	1
5(b)(iv)	carbon/graphite or any metal more reactive than copper;	1
5(c)(i)	79.2828685; 79.6205853; 84.7161572;	2
5(c)(ii)	the last one OR Cu and O ₂ OR the one from copper; not all the copper oxidised OR the outside of the pieces of copper oxidised but the inside did not OR (still) contains copper (metal);	2

Question	Answer	Marks
6(a)(i)	$\text{Al}^{3+} + 3\text{e} \rightarrow \text{Al}$ formula of Al ³⁺ ion; rest correct;	2
6(a)(ii)	$2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}$ species; balancing;	2

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Question	Answer	Marks
6(a)(iii)	endothermic AND (electrical) energy supplied;	1
6(b)(i)	exothermic AND (electrical) energy release;	1
6(b)(ii)	magnesium forms ions (in solution) OR magnesium loses electrons OR magnesium is oxidised; copper is deposited (on the electrode) OR copper ions become copper atoms OR copper ions gain electrons OR copper ions are reduced;	2
6(b)(iii)	M1 set up a magnesium / manganese cell; M2 the negative electrode (is the more reactive) OR the electrode that loses mass (is more reactive); OR M1 replace magnesium with manganese; M2 if voltage less (positive) manganese is less reactive OR if voltage is more (positive) manganese is more reactive;	2
6(c)	$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$ species; balancing;	2
6(d)(i)	(light from the) sun / sunlight;	1
6(d)(ii)	carbon dioxide + water \rightarrow glucose + oxygen;	1

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Question	Answer	Marks
7(a)(i)	alkenes have a (carbon to carbon) double bond;	1
7(a)(ii)	alkene; C_nH_{2n} or twice as many hydrogen atoms as carbon atoms;	2
7(a)(iii)	add bromine (water); remains brown / orange / yellow / no change; becomes colourless / decolourised;	3
7(b)(i)	 <p>correct structure with at least two carbons and single C-C bond; continuation bonds with at least 2 carbon atoms in chain; two or more correct repeat units (with correct use of n, if used) OR correct use of n;</p>	3
7(b)(ii)	$CH_3-CH=CH-CH_3$;	2
7(b)(iii)	<p><i>one from:</i> addition polymerisation polymer only product; addition polymerisation same functional group in all monomers or C=C in monomers; addition polymer has same empirical formula as monomer;</p> <p><i>one from:</i> condensation makes (polymer and) simple/small molecule OR water OR hydrogen chloride; condensation polymerisation monomers have two (different) functional groups;</p>	2
7(b)(iv)	polyester / polyamide;	1