

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

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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	Guidance
1(a)(i)	AlF ₃ ;	1	
1(a)(ii)	As ₂ O ₃ ;	1	A As ₂ O ₅
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	R wrong symbols for O for M2 R wrong symbols for C for M3 I missing symbols A any combination of x and o

Question	Answer	Marks	Guidance
2(a)	carbon monoxide;	1	A CO
2(b)	sodium oxide;	1	A Na ₂ O
2(c)	sulfur dioxide;	1	A SO ₂
2(d)	zinc oxide OR aluminium oxide;	1	A ZnO or Al ₂ O ₃
2(e)	silicon(IV) oxide;	1	A silicon (di)oxide or SiO ₂
2(f)	sulfur dioxide;	1	A SO ₂

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Question	Answer	Marks	Guidance
3(a)	carbon dioxide escapes / leaves / lost / released OR not a closed system;	1	A gas escapes / leaves / lost / released
3(b)	CaO + H ₂ O → Ca(OH) ₂ reactants; product;	2	One mark for each side correct A multiples I state symbols
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	Correct answer scores both marks A answers in g or kg
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	A does not leach out
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	A CaCO ₃ is a base
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	Guidance
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	I ethane / oil / naphtha / coal / gas R coke / bitumen / lubricating oil / wood
4(a)(ii)	(burn to) release energy; take a long time to form (from organic material);	2	If time stated 1000 years or more
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	A correct formulae throughout A sulfurous acid if sulfur reacts with oxygen and water
4(b)(ii)	oxygen and nitrogen react; making oxides of nitrogen; (oxides of nitrogen) react with water (making nitric acid);	3	A nitrogen combust R if oxygen or nitrogen originate from the fuel A named oxide of nitrogen A correct formulae A NO _x
4(b)(iii)	add sodium hydroxide (solution) and aluminium; (warm) and ammonia made;	2	A zinc or Devarda's A description of smell of ammonia or test for ammonia

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Question	Answer	Marks	Guidance
4(b)(iv)	M1 measure pH/describe how to measure pH (such as use universal indicator); M2 lower pH greater concentration of H^+; OR M1 add Ca, Mg, Zn, Fe; M2 faster reaction greater concentration of H^+ /faster bubbles or more hydrogen (in same time); OR M1 rate of reaction with (metal) carbonate; M2 faster reaction greater concentration of H^+ /faster bubbles or more carbon dioxide (in same time); OR M1 electrical conductivity; M2 greater conductivity greater concentration of H^+; OR M1 titrate with (named) alkali; M2 correct result;	2	A M2 if non specified or other metal added in M1

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Question	Answer	Marks	Guidance
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	A multiples I state symbols
5(b)(i)	(black to) pink / brown / orange;	1	I red
5(b)(ii)	(hot) copper reacts / is oxidised; with oxygen / air;	2	A forms copper oxide for 2 marks
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	Minimum 3 sig figs A rounding or truncating <i>All three correct = 2 marks,</i> <i>Two correct = 1 mark</i>
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	ecf of biggest for M1

Question	Answer	Marks	Guidance
6(a)(i)	$\text{Al}^{3+} + 3\text{e} \rightarrow \text{Al}$ formula of Al^{3+} ion; rest correct;	2	A multiples I state symbols A – 3e on right

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Question	Answer	Marks	Guidance
6(a)(ii)	$2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}$ species; balancing;	2	A multiples I state symbols A – 4e on left
6(a)(iii)	endothermic AND (electrical) energy supplied;	1	A energy required to break bonds
6(b)(i)	exothermic AND (electrical) energy release;	1	I heat energy
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	A magnesium dissolves/goes into solution A equation (balanced or unbalanced) A equation (balanced or unbalanced) I use of terms anode or cathode
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	A replace Cu with Mn A converse
6(c)	$\text{C}_3\text{H}_8 + 5\text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$ species; balancing;	2	A multiples I state symbols
6(d)(i)	(light from the) sun/sunlight;	1	A uv
6(d)(ii)	carbon dioxide + water $\rightarrow$ glucose + oxygen;	1	A starch/sugar/(named)carbohydrate I energy or light on LHS

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Question	Answer	Marks	Guidance
7(a)(i)	alkenes have a (carbon to carbon) double bond;	1	A “they” for alkenes A alkanes do not have a (carbon to carbon) double bond
7(a)(ii)	alkene; C_nH_{2n} or twice as many hydrogen atoms as carbon atoms;	2	A fits general formula for alkenes
7(a)(iii)	add bromine (water); remains brown / orange / yellow / no change; becomes colourless / decolourised;	3	I red A M2 and M3 only available if M1 correct or close (such as bromide or bromination) I clear
7(b)(i)	 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;	3	I incorrect additional units R any incorrect units or non-integral number of repeat units
7(b)(ii)	$CH_3-CH=CH-CH_3$;	2	A award 1 mark for any monomer with C=C as long as both carbons have the correct valency I names

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Question	Answer	Marks	Guidance
7(b)(iii)	<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; <i>one from:</i> condensation makes (polymer and) simple/small molecule OR water OR hydrogen chloride; condensation polymerisation monomers have two (different) functional groups;	2	A only one monomer A (normally two) different monomers
7(b)(iv)	polyester / polyamide;	1	A protein / polysaccharide / polypeptide / complex carbohydrate I names