

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

Cambridge International General Certificate of Secondary Education

**MARK SCHEME for the October/November 2015 series****0620 CHEMISTRY****0620/32**

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
- () the word or phrase in brackets is not required but sets the context
- **A** accept (a less than ideal answer which should be marked correct)
- **I** ignore (mark as if this material were not present)
- **R** reject
- ecf credit a correct statement that follows a previous wrong response
- ora or reverse argument
- owtte or words to that effect (accept other ways of expressing the same idea)

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
1(a)(i)	NF <sub>3</sub> ;	<b>1</b>
1(a)(ii)	P <sub>2</sub> S <sub>3</sub> ;	<b>1</b>
1(b)(i)	Se <sup>2-</sup> ;	<b>1</b>
1(b)(ii)	Ga <sup>3+</sup> ;	<b>1</b>
1(c)(i)	Cr <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> ;	<b>1</b>
1(c)(ii)	Ba(OH) <sub>2</sub> ;	<b>1</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(a)(i)	combustion / burning of a motor vehicle fuel or a named fuel which can act as a motor vehicle fuel; incomplete combustion would produce CO; complete combustion would produce CO <sub>2</sub> ;	<b>3</b>
2(a)(ii)	<i>carbon dioxide</i> : climate change / global warming / greenhouse effect; <i>carbon monoxide</i> : poisonous / toxic;	<b>2</b>
2(a)(iii)	nitrogen and oxygen react or combine; at high temperatures or in presence of spark;	<b>2</b>
2(a)(iv)	it reacts or combines with oxygen / NO + ½O <sub>2</sub> → NO <sub>2</sub> ;	<b>1</b>
2(b)	any two from: <ul style="list-style-type: none"> <li>• acid rain is formed;</li> <li>• lowers pH or acidifies lakes / rivers or kills fish / aquatic animals;</li> <li>• changes composition of soils or reduces fertility of soil or reduces crop yields / deforestation or kills crops or trees or plants or leaves / lowers pH of soil or increases acidity of soil;</li> <li>• attacks (limestone) buildings or statues; attacks metal (structures) / bridges;</li> </ul>	<b>2</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(c)	use of a catalytic converter; $2\text{NO} + 2\text{CO} \rightarrow 2\text{CO}_2 + \text{N}_2$ species; balancing;	<b>3</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
3(a)	zinc blende is burnt/roasted/heated in air; zinc sulfide + oxygen $\rightarrow$ zinc oxide + sulfur dioxide;	<b>2</b>
3(b)	zinc oxide + carbon $\rightarrow$ zinc + carbon dioxide/monoxide;	<b>1</b>
3(c)	zinc sulfate; pure zinc; $\text{Zn}^{2+} + 2\text{e}^- \rightarrow \text{Zn}$ ; $\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}^-$ ; zinc <u>ions</u> are removed (from solution) and replaced (into solution); at the same rate/speed;	<b>6</b>
3(d)(i)	copper;	<b>1</b>
3(d)(ii)	any two from: <ul style="list-style-type: none"> <li>• hard(er)/less malleable;</li> <li>• strong(er);</li> <li>• (better) appearance;</li> <li>• (more) resistant to corrosion;</li> </ul>	<b>2</b>
3(e)(i)	steel (or iron) is exposed to oxygen <b>and</b> water;	<b>1</b>
3(e)(ii)	Zn more reactive than Fe (allow steel); Zn loses/transfers electrons (more readily) <b>and</b> forms (+ve) ions (in preference to Fe); Fe (allow steel) is more reactive than Cu; Fe loses/transfers electrons (more readily) <b>and</b> forms (+ve) ions (in preference to Cu);	<b>4</b>

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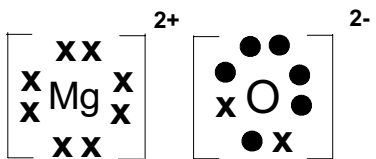
Question	Answer	Marks
4(a)(i)	a reaction whose rate is influenced by light/ reaction which occurs in presence of light;	1
4(a)(ii)	$\text{CH}_3\text{CHClCH}_3$ ;	1
4(a)(iii)	(both have) same molecular formula; different structural formula or structure;	2
4(b)	<b>M1</b> bonds breaking = $(8 \times 412) + (2 \times 348) + 242 = 4234$ ; <b>M2</b> bonds forming = $(7 \times 412) + (2 \times 348) + 338 + 431 = 4349$ ; <b>M3</b> $4234 - 4349 = -115$ <b>and</b> exothermic;	3
4(c)(i)	$\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl} + \text{NaOH} \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{OH} + \text{NaCl}$ NaCl as product; rest of equation;	2
4(c)(ii)	propene; $\text{CH}_2=\text{CHCH}_3$ ;	2
4(c)(iii)	propanoic acid;	1
4(d)(i)	46;	1
4(d)(ii)	60;	1
4(d)(iii)	moles of $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} = 0.1$ ; moles of $\text{HCOOH} = 0.087$ (0.09) <b>and</b> limiting reagent is methanoic acid;	2
4(d)(iv)	$88 \times$ (mol of limiting reagent in <b>4(d)(iii)</b> ); expected answer: $88 \times 0.087 = 7.65$ g;	1

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Question	Answer	Marks
5(a)	as a reducing agent; source of heat/energy;	2
5(b)	$\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$ species; balancing;	2
5(c)	silica reacts with limestone or calcium oxide; to form a slag or calcium silicate or $\text{CaSiO}_3$ ; (liquid) slag floats (above molten iron);	3
5(d)	<u>blow</u> or <u>pass</u> oxygen through (molten) iron; $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$ ; carbon dioxide escapes or carbon dioxide is a gas;	3

Question	Answer	Marks
6(a)	the number of $e^-$ gained or lost = numerical value of oxidation state;	1
	any two from: <ul style="list-style-type: none"> <li>• Na to Al (Si) lose <math>e^-</math>;</li> <li>• (Si) P to Cl gain <math>e^-</math>;</li> <li>• Si gains and loses <math>e^-</math> / Ar neither gains nor loses <math>e^-</math>;</li> </ul>	2
6(b)	<b>M1</b> positive ions / cations / metallic ions; the (correct) particles named in <b>M1</b> are arranged in a lattice / rows / layers; sea of electrons / delocalised electrons;	3
6(c)	they have mobile electrons;	1
6(d)	chlorine;	1
6(e)	strong covalent bonds ; in a giant lattice / macromolecule / giant (structure);	2

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Question	Answer	Marks
6(f)	any two from: <ul style="list-style-type: none"> <li>sodium chloride is ionic <b>and</b> <math>\text{PCl}_3</math> is covalent;</li> <li>ionic bonds are strong <b>and</b> intermolecular forces are weak;</li> <li><math>\text{PCl}_3</math> reacts with water <b>and</b> <math>\text{NaCl}</math> does not;</li> </ul>	2
6(g)	MgO will react with / dissolve in / neutralise hydrochloric acid / acid / acid oxide; if amphoteric, MgO will react with or dissolve in or neutralise hydrochloric acid or acid or acid oxide <b>and</b> MgO will react with dissolve in or neutralise sodium hydroxide or alkali or base or basic oxide;  MgO will not react with or dissolve in or neutralise sodium hydroxide or alkali or base or basic oxide = [2]	2
6(h)	 <p>magnesium with 8 or 0 outer shell electrons; oxygen with 8 outer shell electrons and 2 indicated differently from the other 6 and these 2 electrons must match the Mg electrons if these have been shown; correct charges;</p>	3