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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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Question	Answer	Marks
1(a)(i)	NF_3;	1
1(a)(ii)	P_2S_3;	1
1(b)(i)	Se^{2-};	1
1(b)(ii)	Ga^{3+};	1
1(c)(i)	$Cr_2(SO_4)_3$;	1
1(c)(ii)	$Ba(OH)_2$;	1

Question	Answer	Marks
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_2;	3
2(a)(ii)	*carbon dioxide*: climate change / global warming / greenhouse effect; *carbon monoxide*: poisonous / toxic;	2
2(a)(iii)	nitrogen and oxygen react or combine; at high temperatures or in presence of spark;	2
2(a)(iv)	it reacts or combines with oxygen / $NO + ½O_2 \rightarrow NO_2$;	1
2(b)	any two from: • acid rain is formed; • lowers pH or acidifies lakes / rivers or kills fish / aquatic animals; • 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; • attacks (limestone) buildings or statues; attacks metal (structures) / bridges;	2

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Question	Answer	Marks
2(c)	use of a catalytic converter; $2NO + 2CO \rightarrow 2CO_2 + N_2$ species; balancing;	3

Question	Answer	Marks
3(a)	zinc blende is burnt / roasted / heated in air; zinc sulfide + oxygen → zinc oxide + sulfur dioxide;	2
3(b)	zinc oxide + carbon → zinc + carbon dioxide / monoxide;	1
3(c)	zinc sulfate; pure zinc; $Zn^{2+} + 2e^- \rightarrow Zn$; $Zn \rightarrow Zn^{2+} + 2e^-$; zinc ions are removed (from solution) and replaced (into solution); at the same rate / speed;	6
3(d)(i)	copper;	1
3(d)(ii)	any two from: • hard(er) / less malleable; • strong(er); • (better) appearance; • (more) resistant to corrosion;	2
3(e)(i)	steel (or iron) is exposed to oxygen **and** water;	1
3(e)(ii)	Zn more reactive than Fe (allow steel); Zn loses / transfers electrons (more readily) **and** forms (+ve) ions (in preference to Fe); Fe (allow steel) is more reactive than Cu; Fe loses / transfers electrons (more readily) **and** forms (+ve) ions (in preference to Cu);	4

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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)	$CH_3CHCl CH_3$;	1
4(a)(iii)	(both have) same molecular formula; different structural formula or structure;	2
4(b)	**M1** bonds breaking = (8 × 412) + (2 × 348) + 242 = 4234; **M2** bonds forming = (7 × 412) + (2 × 348) + 338 + 431 = 4349; **M3** 4234 – 4349 = –115 **and** exothermic;	3
4(c)(i)	$CH_3CH_2CH_2Cl + NaOH \rightarrow CH_3CH_2CH_2Cl + NaCl$ $NaCl$ as product; rest of equation;	2
4(c)(ii)	propene; $CH_2=CHCH_3$;	2
4(c)(iii)	propanoic acid;	1
4(d)(i)	46;	1
4(d)(ii)	60;	1
4(d)(iii)	moles of $CH_3CH_2CH_2OH$ = 0.1; moles of HCOOH = 0.087 (0.09) **and** limiting reagent is methanoic acid;	2
4(d)(iv)	88 × (mol of limiting reagent in **4(d)(iii)**); expected answer: 88 × 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)	$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ species; balancing;	**2**
5(c)	silica reacts with limestone or calcium oxide; to form a slag or calcium silicate or $CaSiO_3$; (liquid) slag floats (above molten iron);	**3**
5(d)	<u>blow</u> or <u>pass</u> oxygen through (molten) iron; $C + O_2 \rightarrow CO_2$; 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; any two from: • Na to A*l* (Si) lose e^-; • (Si) P to C*l* gain e^-; • Si gains and loses e^- / Ar neither gains nor loses e^-;	**1** **2**
6(b)	**M1** positive ions / cations / metallic ions; the (correct) particles named in **M1** 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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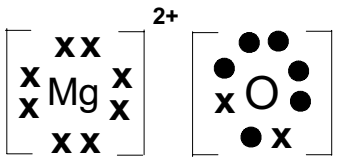
Question	Answer	Marks
6(f)	any two from: • sodium chloride is ionic **and** PCl_3 is covalent; • ionic bonds are strong **and** intermolecular forces are weak; • PCl_3 reacts with water **and** $NaCl$ does not;	**2**
6(g)	MgO will react with / dissolve in / neutralise hydrochloric acid / acid / acid oxide; if amphoteric, MgO will react with or dissolve in or neutralise hydrochloric acid or acid or acid oxide **and** 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)	 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;	**3**

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