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Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/42**

Paper 4 Theory (Extended) **May/June 2016**

MARK SCHEME

Maximum Mark: 80

Published

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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)	nitrogen / oxygen / fluorine / neon;	**1**
1(a)(ii)	carbon;	**1**
1(a)(iii)	oxygen;	**1**
1(a)(iv)	nitrogen;	**1**
1(a)(v)	neon;	**1**
1(a)(vi)	carbon;	**1**
1(a)(vii)	lithium / fluorine;	**1**
1(a)(viii)	lithium;	**1**
1(b)(i)	B_2O_3;	**1**
1(b)(ii)	Li_3N;	**1**

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Question	Answer	Marks
2(a)(i)	number of protons in one atom of an element;	1
2(a)(ii)	**M1** number of protons and neutrons in one atom of an element; **M2** in one atom of an element;	2 1 1
2(b)	A 6 6 6 $^{12}_{6}C$ B 12 12 12 $^{24}_{12}Mg$; C 8 10; 8; $^{16}_{8}O^{2-}$ D 11 10 13 $^{24}_{11}Na^{+}$ 11, 24; Na;+;	6

Question	Answer	Marks
3(a)(i)	**M1** positive ions / cations (labelled or named in text); **M2** electrons (labelled or named in text); **M3** attraction between positive and negative;	3 1 1 1
3(a)(ii)	(conduction due to) movement of electrons / mobile electrons;	1
3(b)	$GaCl_3$; $Ga_2(SO_4)_3$;	2 1 1
3(c)(i)	$Ga_2O_3 + 6HNO_3 \rightarrow 2Ga(NO_3)_3 + 3H_2O$ formula of $Ga(NO_3)_3$; all formulae and balancing correct;	2
3(c)(ii)	$Ga_2O_3 + 2NaOH \rightarrow Na_2Ga_2O_4 + H_2O$; formula of $Na_2Ga_2O_4$; all formulae and balancing correct;	2

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Question	Answer	Marks
3(d)	any 2 from: • (do not) corrode; • strong; • hard; • (improved) appearance;	**2**

Question	Answer	Marks
4(a)	**M1** substance that speeds up a reaction / increases rate; **M2** unchanged (chemically) at the end / not used up / lowers activation energy / provides alternative pathway;	**2** 1 1
4(b)	**M1** too slow / slower; **M2** lower yield / less product(s) / equilibrium shifts to left / equilibrium shifts in direction of reactants / backward reaction favoured / reverse reaction favoured;	**2** 1 1
4(c)	faster / increase rate;	**1**
4(d)	lower yield / less product(s) / equilibrium shifts to left / equilibrium shifts in direction of reactants / backward reaction favoured / reverse reaction favoured; **OR** higher cost / expensive; **OR** safety risks;	**1**
4(e)(i)	**M1** breakdown of an ionic compound when molten or in aqueous solution; **M2** (using) electricity / electric current / electrical energy;	**2** 1 1
4(e)(ii)	carbon / graphite / platinum;	**1**

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Question	Answer	Marks
4(e)(iii)	$2H^+ + 2e(^-) \rightarrow H_2$; **OR** $2H_3O^+ + 2e(^-) \rightarrow H_2 + 2H_2O$;	**1**
4(e)(iv)	cathode / negative electrode;	**1**
4(e)(v)	**M1** damp blue litmus paper; **M2** bleaches / loses colour / turns white / turns colourless;	**2** 1 1
4(f)	$2NaCl + 2H_2O \rightarrow 2NaOH + H_2 + Cl_2$ all formulae correct; balancing;	**2**
4(g)	**M1** *chlorine*: treating (drinking) water / treating water in swimming pools / kill bacteria in water / chlorination of water / (manufacture of) paper products / plastics / PVC / dyes / textiles / medicines / antiseptics / insecticides / herbicides / fungicides / solvents / paints / disinfectant / bleach / hydrochloric acid; **M2** *sodium hydroxide*: drain cleaner / oven cleaner / extraction of aluminium / purification of bauxite / (manufacture of) biodiesel / paper / soap / detergents / washing powder / textiles / dyes; **M3** *hydrogen*: fuel / rocket fuel / fuel cells / in welding / (manufacture of) ammonia / NH_3 / margarine / methanol / hydrochloric acid / refrigerants;	**3** 1 1 1

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Question	Answer	Marks
5(a)(i)	more than enough to react (with all the hydrocarbon); **OR** (some) oxygen remaining;	**1**
5(a)(ii)	75 cm^3;	**1**
5(a)(iii)	2 : 15 : 10;	**1**
5(a)(iv)	 2 : 15 : 10 : 10; C_5H_{10};	**2** 1 1
5(b)(i)	C_7H_{16};	**1**
5(b)(ii)	contains a double bond / triple bond / multiple bond; **OR** not all bonds are single bonds;	**1**
5(b)(iii)	 test: aqueous bromine / bromine (water) / Br_2; result: (orange / yellow / brown) to colourless / decolourised / colour disappears;	**2** 1 1
5(c)(i)	addition;	**1**
5(c)(ii)	1 (kg);	**1**
5(c)(iii)	 propene: CH_2; polypropene: CH_2;	**2** 1 1

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Question	Answer	Marks
6(a)(i)	roast / heat **and** in air / oxygen;	**1**
6(a)(ii)	$2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$; SO_2 on right of equation; all formulae and balancing correct;	**2**
6(b)(i)	**M1** heat produced by carbon / coke (burning in) oxygen / air; **OR** $C + O_2 \rightarrow CO_2$ produces heat / exothermic; **OR** $2C + O_2 \rightarrow 2CO$ produces heat / exothermic (scores **M1** and **M2**); **M2** $C + CO_2 \rightarrow 2CO$; **OR** $2C + O_2 \rightarrow 2CO$; **M3** $ZnO + CO \rightarrow Zn + CO_2$; **OR** $ZnO + C \rightarrow Zn + CO$; **OR** $2ZnO + C \rightarrow 2Zn + CO_2$;	**3** 1 1 1
6(b)(ii)	temperature (inside the furnace) is above 907 °C / temperature (inside the furnace) is above the boiling point (of zinc) / 1000 °C is above the boiling point (of zinc);	**1**
6(b)(iii)	condensation / condensing / condense;	**1**
6(c)	**M1** zinc is more reactive than iron / zinc is higher in the reactivity series than iron ora; **M2** zinc loses electrons; **M3** iron / steel / oxygen / air / water gains electrons **OR** electrons move to iron / steel / oxygen / air / water; **M4** (therefore) iron does not lose electrons / get oxidised / form iron(II) / form iron(III);	**4** 1 1 1 1

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Question	Answer	Marks
6(d)(i)	green precipitate; red-brown / brown / orange precipitate;	**2** 1 1
6(d)(ii)	oxidising agent / oxidant;	**1**
6(d)(iii)	reducing agent / reductant;	**1**
6(d)(iv)	iron(III) / Fe^{3+};	**1**
6(d)(v)	iron(II) / Fe^{2+};	**1**

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