Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/42**

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

MARK SCHEME

Maximum Mark: 80

Published

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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This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

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

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

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

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

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

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

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

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**