Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/31**

Paper 3 Theory (Core) **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)	B / chlorine / Cl_2;	**1**
1(a)(ii)	C / KCl / potassium chloride;	**1**
1(a)(iii)	B; has only one type of atom;	**2** 1 1
1(a)(iv)	$C_3H_3F_3Cl_2$;	**1**
1(b)(i)	different number of neutrons / different mass numbers / different numbers of nucleons;	**1**
1(b)(ii)	18;	**1**
1(b)(iii)	7 electrons in the outer shell; first shell has 2 electrons and second shell has 8 electrons;	**2** 1 1

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Question	Answer	Mark
2(a)	stainless steel; any 2 from: (very) strong; (good) resistance to corrosion; cheap; **OR** iron; strong; cheap; **OR** aluminium; low density; (good) resistance to corrosion; **OR** titanium; any 2 from: strong; (good) resistance to corrosion; low density; **OR** zinc; (good) resistance to corrosion;	**3**
2(b)(i)	bauxite;	**1**
2(b)(ii)	aluminium is too reactive / aluminium is high in the electrochemical series / aluminium is very reactive;	**1**

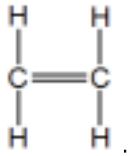
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Question	Answer	Mark
2(b)(iii)	anode: oxygen / O_2; cathode: aluminium / A*l*;	**2** 1 1
2(c)	any 4 from: • atoms in gas far apart / all over the place; • atoms in gas moving (very) fast / move freely / bouncing around / move randomly; • atoms slow down during condensation / move less than before; • atoms get closer together in condensation; • atoms in liquid are close together / touching; • atoms in liquid slide over each other / atoms in liquids move slowly / restricted movement; • atoms slow down (further) during freezing / atoms in liquid move more than in solid; • atoms in solid only vibrate; • atoms in solid are / touching / close to each other / closely packed / tightly packed;	**4**

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Question	Answer	Marks
3(a)(i)	decreases down the Group I / increases up the Group I;	**1**
3(a)(ii)	1.88 (1.60–2.50) (g / cm^3);	**1**
3(a)(iii)	solid; 20°C is below the melting point / the melting point is above 20°C;	**2** 1 1
3(b)	rubidium hydroxide; hydrogen;	**2** 1 1
3(c)	155; (1 mark for hydrogen = (6 × 1) = 6 / sodium = (1 × 23) = 23)	**2**
3(d)(i)	pencil will not smear / pencil line will not move / ink will smear / ink will undergo chromatography / ink would spread / ink would travel upwards / pencil mark would not spread;	**1**
3(d)(ii)	K;	**1**
3(d)(iii)	J;	**1**
3(d)(iv)	J;	**1**

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Question	Answer	Marks
4(a)(i)	S and U; both have OH (group);	**2** 1 1
4(a)(ii)	Q and T;	**1**
4(b)	compounds; chemical; functional;	**3** 1 1 1
4(c)(i)	 ;	**1**
4(c)(ii)	aqueous bromine is added to (test tube of) ethene / aqueous bromine is orange; aqueous bromine turns colourless / solution turns colourless;	**2** 1 1
4(c)(iii)	high temperature / heat;	**1**
4(c)(iv)	$C_{13}H_{28}$;	**1**

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Question	Answer	Marks
5(a)	any 3 physical properties: • melting point increases down the Group; • boiling point increases down the Group; • density increases down the Group; • colour gets darker down the Group / states goes from gas to liquid to solid down the Group; reactivity: • more reactive halogen displaces less reactive halogen (from halide); • correct word equation, e.g. chlorine + potassium bromide → potassium chloride + bromine;	**5** 3 2
5(b)(i)	nitrogen dioxide (formed) / NO_2 (formed) / nitrogen oxide (formed) / gas (formed); damages lungs / irritates eyes / sore throat / skin burns / difficulty swallowing / persistent coughing / headache / vomiting;	**2** 1 1
5(b)(ii)	pH 1;	**1**
5(b)(iii)	zinc nitrate; water;	**2** 1 1

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Question	Answer	Marks
6(a)	increases rate of reaction / speeds up reaction;	**1**
6(b)	⇌;	**1**
6(c)	exothermic **and** products have less energy than reactants;	**1**
6(d)(i)	(yield) decreases with increasing temperature ora / the lower the temperature, the higher the yield ora;	**1**
6(d)(ii)	42%;	**1**
6(e)	(damp) red litmus paper turns blue (1 mark for red litmus paper) **OR** concentrated HCl (on glass rod) gives white fumes (1 mark for concentrated HCl (on glass rod))	**2** 2 2
6(f)	add Universal Indicator to the solution / observe colour; compare with colour chart;	**2** 1 1
6(g)	2 (NH_3); 6 (HCl);	**2** 1 1

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Question	Answer	Marks
7(a)	(gas) syringe leading to flask / beaker / test tube **OR** flask and tube leading to upturned measuring cylinder over trough of water; closed apparatus with no air gaps;	**2** 1 1
7(b)(i)	small pieces; line / curve / graph steepest;	**2** 1 1
7(b)(ii)	line to the left of the small pieces starting at (0, 0); finishing at 45 cm^3 and before the other lines;	**2** 1 1
7(b)(iii)	any value between 205 s and 215 s (inclusive);	**1**
7(c)(i)	neutralising (acidic) soils / neutralising (acidic) waste / steelmaking / self-heating cans / making concrete / making glass / water treatment / making plaster / making paper / flue-gas desulfurisation / neutralising acids / making limewater;	**1**
7(c)(ii)	basic oxide; because it is a metal oxide / because it would react with acid / neutralizes acids / calcium is on the left of the Periodic Table;	**2** 1 1

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Question	Answer	Marks
8(a)	copper(II) oxide; loses oxygen;	**2** 1 1
8(b)(i)	(mass of copper oxide in tube) decreases;	**1**
8(b)(ii)	hydrogen is flammable / hydrogen is explosive;	**1**
8(b)(iii)	anhydrous copper(II) sulfate goes blue / white copper(II) sulfate goes blue (1 mark for anhydrous copper (II) sulfate / white copper(II) sulfate) **OR** anhydrous cobalt(II) chloride goes pink / blue cobalt(II) chloride goes pink (1 mark for anhydrous cobalt(II) chloride / blue cobalt(II) chloride)	**2** 2 2

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