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

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.

Cambridge will not enter into discussions about these mark schemes.

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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

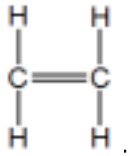
- ; separates marking points
- / separates alternatives within a marking point
- **OR** gives alternative marking point
- **R** reject
- **I** ignore mark as if this material was not present
- **A** accept (a less than ideal answer which should be marked correct)
- **COND** indicates mark is conditional 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)	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

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**

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**

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**

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**

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

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

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

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