Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/31**

Paper 3 Core Theory **October/November 2016**

MARK SCHEME

Maximum Mark: 80

Published

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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Question	Answer	Mark
1(a)(i)	H / hydrogen	**1**
1(a)(ii)	H / hydrogen	**1**
1(a)(iii)	S / sulfur	**1**
1(a)(iv)	Ca / calcium	**1**
1(a)(v)	A*l* / aluminium	**1**
1(b)(i)	atoms with the same number of protons but different <u>number</u> of neutrons **OR** atoms of the same element with different <u>number</u> of neutrons	**1** **1** **1** **1**
1(b)(ii)	124	**1**
1(b)(iii)	80	**1**
1(b)(iv)	78	**1**

Question	Answer	Mark
2(a)(i)	any 2 from: • more Na^+ ions in sample **B ORA** • more Cl^- ions in sample **B ORA** • more Mg^{2+} ions in sample **B ORA** • more HCO_3^- ions in sample **A ORA** • more Ca^{2+} ions in sample **A ORA** • more K^+ ions in sample **A ORA** • more SiO_3^{2-} ions in sample **A ORA**	**2**
2(a)(ii)	Mg^{2+}	**1**
2(a)(iii)	2 mg = [2] $\frac{200}{1000} \times (10)$ = [1] **OR** $0.2 \times (10)$ = [1]	**2**
2(b)	*test:* flame test / description of flame test *result:* yellow (flame)	**2**
2(c)	Brownian (motion)	**1**
2(d)(i)	indicates a reversible reaction	**1**
2(d)(ii)	dip (indicator) paper in solution / put (indicator paper) in solution compare the colour with the (colour) chart / different colours represent different pH values	**1** **1**
2(d)(iii)	absorbs heat / absorbs infra-red radiation / causes global warming	**1**
2(d)(iv)	*gas:* methane *source:* gases from (digestion in) animals / swamps / decomposition of vegetation / rice paddy fields / fracking / melting of permafrost /	**1** **1**

Question	Answer	Mark
3(a)	2 electrons in the outer shell inner shells correct (2, 8, 8)	**1** **1**
3(b)	cathode electrolyte anode	**2**
3(c)	H_2 (on right) $2(H_2O)$ (on left)	**1** **1**
3(d)	*manufacture* (max = [2]) • limestone / calcium carbonate heated • thermal decomposition • heated in kiln / heated in current of air / coke for heating / carbon for heating *uses* (max = [2]) • neutralise acidic waste / treating flue gases • neutralise acidic soils • steelmaking / removing impurities in iron • (lime) mortar / cement / plaster / lime wash • slaked lime / limewater *equation* (max = [2]) • e.g. calcium carbonate $\rightarrow$ calcium oxide + carbon dioxide • calcium oxide + acid $\rightarrow$ calcium salt + water	**4**

Question	Answer	Mark
4(a)	any 3 from: • diffusion • particles move / motion of particles • (movement is) random / in any direction / in all directions • particles spread out / particles mix • particles move from high to low concentration	**3**
4(b)(i)	energy (production) / power (production)	**1**
4(b)(ii)	any suitable use, e.g. treatment of cancer / tracer / thyroid function / sterilising (medical) instruments /	**1**
4(b)(iii)	average mass of <u>atoms</u> (of an element) (on a scale where) the ^{12}C atom has a mass of (exactly) 12 (units)	**1** **1**
4(c)(i)	Cl_2 (on left) 2(KCl) (on right)	**1** **1**
4(c)(ii)	any suitable use, e.g. sterilising / killing bacteria / swimming pools / bleach /	**1**
4(c)(iii)	<u>acidic</u> because chlorine is a non-metal / <u>acidic</u> because chlorine is on the right of the Periodic Table	**1**
4(c)(iv)	goes colourless / bleached / (goes) white	**1**

Question	Answer	Mark
5(a)(i)	the more carbon, the higher the strength **ORA**	**1**
5(a)(ii)	(no) the melting point range does not increase regularly / the melting point range goes up and down / the melting point range remains fairly constant **OR** (yes) the more carbon, the greater the melting point range / the difference between the higher and lower number is greater with more carbon **OR** (yes) the average melting point range is higher the more carbon (except for **D**) / the general trend is for a higher melting point range with more carbon	**1**
5(a)(iii)	**D** because it is resistant to corrosion	**1**
5(b)	**A**	**1**
5(c)(i)	gives strength / so the wire does not break / so the wire does not sag / for support	**1**
5(c)(ii)	*use:* any suitable use, e.g. food container / saucepan / aircraft body / *property:* any suitable property related to the use, e.g.(food container) resistant to acidic foods / (saucepan) good conductor of heat / (aircraft body) low density /	**1** **1**
5(d)(i)	A*l* / aluminium it gains oxygen	**1** **1**
5(d)(ii)	<u>exothermic</u> because the reactants have more energy than the products / <u>exothermic</u> because the products have less energy than the reactants	**1**

Question	Answer	Mark
6(a)	*effect on indicator* (max = [1]) • turn (blue) litmus red • turn methyl orange red / pink *reaction with metals* (max = [1]) • react with metals to produce hydrogen • react with metals to form a salt *reaction with bases* (max = [1]) • react with bases to form a salt and water *reaction with carbonates* (max = [1]) • react with carbonates to form a salt and water • react with carbonates to form carbon dioxide *one other effect / reaction* (max = [1]) • e.g. have a sour taste / pH below 7 / another property selected from the bullet points above	**4**
6(b)(i)	density decreases as the number of carbon atoms increases **ORA**	**1**
6(b)(ii)	values between and including 170 (°C)–220 (°C)	**1**
6(b)(iii)	solid its melting point is above 15 °C / 15 °C is below its melting point	**1** **1**
6(b)(iv)	displayed structure of COOH group showing all of the atoms and all of the bonds	**1**
6(b)(v)	88 4 × C **OR** 8 × H **OR** 2 × O **OR** C = 48 **OR** O = 32 scores [1]	**2**
6(c)	physical / chemical / physical	**2**

Question	Answer	Mark
7(a)	**A** = melting / fusion **B** = boiling / vaporisation	**1** **1**
7(b)	*arrangement:* irregular / random / no fixed position / no (fixed) arrangement *motion:* rapid / fast / random	**2**
7(c)	any suitable use, e.g. tyre manufacture / making sulfur dioxide / making sulfuric acid / pesticide / insecticide /	**1**
7(d)	sulfur dioxide is formed sulfur dioxide causes irritation of the throat (**OR** nose **OR** lungs **OR** eyes or skin)	**1** **1**
7(e)(i)	C_4H_4S	**1**
7(e)(ii)	speeds up the rate of a reaction	**1**
7(e)(iii)	25.2 (g)	**1**