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Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2015 series

0620 CHEMISTRY

0620/31 Paper 3 (Extended Theory), maximum raw mark 80

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Abbreviations used in the Mark Scheme

- ; separates marking points
- / separates alternatives within a marking point
- () the word or phrase in brackets is not required but sets the context
- **A** accept (a less than ideal answer which should be marked correct)
- **I** ignore (mark as if this material were not present)
- **R** reject
- ecf credit a correct statement that follows a previous wrong response
- ora or reverse argument
- owtte or words to that effect (accept other ways of expressing the same idea)

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Question	Answer	Marks
1(a)(i)	Na^+ / sodium **and** O^{2-} / oxide;	**1**
1(a)(ii)	Ca^{2+} / calcium;	**1**
1(a)(iii)	P / phosphorus;	**1**
1(a)(iv)	Si / silicon;	**1**
1(b)(i)	• *number of protons* = 29; • *number of neutrons* = 35; • *number of electrons* = 27; three correct = [2]; two correct = [1]	**2**
1(b)(iii)	*number of nucleons* = 45; *number of charged particles* = 42;	**1** **1**
1(c)(i)	have same proton number / same element / same atomic number; different number of neutrons / nucleons / mass number;	**1** **1**
1(c)(ii)	magnesium / Mg;	**1**
1(c)(iii)	any two from: • treating cancer or radiotherapy; • biological tracer; • thickness (of paper or foil); • (checking for) leaks / cracks (in pipes); • (carbon) dating; • (generating) energy / electricity; • smoke detectors; • fill levels in packages; • sterilising surgical instruments;	**2**

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Question	Answer	Marks
2(a)	add a (dilute) acid; filter; copper does not react or dissolve / zinc reacts or dissolves or forms a salt;	**1** **1** **1**
2(b)	diffusion (through a membrane); nitrogen diffuses faster; because it has the smaller M_r; **or** (turn into) liquid; (fractional) distillation; different boiling points; **or** burn a named substance to make non-gaseous product; oxygen reacts / nitrogen does not react; name of product of combustion;	**3**
2(c)	chromatography; use a locating agent / the two acids move at different rates / alanine travels faster / alanine higher up paper / travels further;	**1** **1**
2(d)	add sodium hydroxide solution; filter; zinc hydroxide (is amphoteric it) will react or will dissolve / magnesium hydroxide does not react or does not dissolve;	**1** **1** **1**

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Question	Answer	Marks
3(a)	fast(er) reaction; large(r) surface area;	1 1
3(b)	4.76 (dm^3);	1
3(c)	moves equilibrium to right; increases yield (of sulfur trioxide) / uses up more sulfur dioxide;	1 1
3(d)(i)	moves equilibrium to left; (forward reaction) exothermic;	1 1
3(d)(ii)	decrease rate; molecules have less energy / move slower; fewer collisions (per second) / fewer particles have the activation energy / fewer collisions have the activation energy;	1 1 1
3(e)(i)	moves to right;	1
3(e)(ii)	high yield at 2 atm;	1
3(f)	vanadium(V) oxide / vanadium pentoxide;	1
3(g)	**M1** dissolve / react sulfur trioxide in (concentrated) sulfuric acid; add water to product of **M1**;	1 1

Question	Answer	Marks
4(a)(i)	any two from: • shortage of sites / landfill sites fill up; • visual pollution / litter; • danger to wild life;	2
4(a)(ii)	(produce) toxic gases or CO or HCl or HF / carbon dioxide / greenhouse gases;	1
4(b)	any two from: bags / clothing or specified clothing / packaging / bowls / cups / plates / flooring / carpets / pipes / insulation / non-stick coatings / ropes;	1

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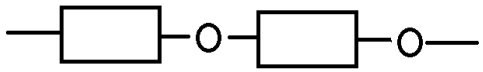
Question	Answer	Marks
4(c)(i)	$CH_2=CHCH_3$ double bond is shown; rest of structure correct;	**2**
4(c)(ii)	ester;	**1**
4(c)(iii)	(carboxylic) acid; alcohol;	**1** **1**
4(d)	addition – polymer only product / only one product; condensation – (polymer and) simple molecule / water / hydrogen chloride made; polymer **A** is an addition polymer **and** polymer **B** is a condensation polymer;	**1** **1** **1**

Question	Answer	Marks
5(a)(i)	adds up to 100%;	**1**
5(a)(ii)	**M1** 55.85/12 **and** 6.97(/1) **and** 37.2/16; **or** evaluation 4.650 6.970 2.325; **M2** C_2H_3O; correct answer with no working = [2]	**1** **1**
5(a)(iii)	**M1** (86/)43; **M2** $C_4H_6O_2$; correct answer with no working = [2]	**1** **1**
5(b)(i)	unsaturated / C=C double bond / alkene;	**1**
5(b)(ii)	(organic / carboxylic) acid / contains or releases H^+ ions;	**1**
5(b)(iii)	$CH_3CH=CHCOOH$ / $CH_2=CHCH_2COOH$ / $CH_2=CH(CH_3)COOH$;	**1**

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Question	Answer	Marks
6(a)(i)	any three from: • each oxygen is joined to two silicons / atoms; • each silicon is joined to four oxygens / atoms; • tetrahedral (around silicon) / similar to diamond; • linear around oxygen;	**3**
6(a)(ii)	any three from: • high melting point / boiling point; • hard; • strong; • (colourless) crystalline (solid); • brittle / not malleable; • poor / non-conductor (of electricity) / insulator; • insoluble (in water);	**3**
6(a)(iii)	SiO_2 reacts with or dissolves in or neutralises an acid or acidic oxide; SiO_2 does not react or dissolve in or neutralise an alkali or base or basic oxide;	**1** **1**
6(b)	carbon dioxide has a simple molecular structure;	**1**

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Question	Answer	Marks
7(a)(i)	**step 2 and** it is electron gain / oxidation state decreases;	**1**
7(a)(ii)	silver (ion) **and** it accepts electrons / gets reduced / oxidation state decreases;	**1**
7(b)	*prediction:* the '*not covered*' section will be black; the '*covered in thick card*' section will be white / cream; the '*covered in thin card*' section will be grey; *explanation:* the more light, the more silver ions are reduced;	 **1** **1** **1** **1**
7(c)(i)	carbon dioxide + water → glucose + oxygen reactants correct; products correct;	 **1** **1**
7(c)(ii)	chlorophyll;	**1**
7(c)(iii)	 one correct –O– link between rectangles; two correct glucose units with continuation bonds;	 **1** **1**
7(c)(iv)	the reaction of glucose with oxygen to release (carbon dioxide and water and) energy; **or** the reaction of glucose in a biological system to release energy;	**1**

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