

CAMBRIDGE INTERNATIONAL EXAMINATIONS**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)	• <i>number of protons</i> = 29; • <i>number of neutrons</i> = 35; • <i>number of electrons</i> = 27; three correct = [2]; two correct = [1]	2
1(b)(iii)	<i>number of nucleons</i> = 45; <i>number of charged particles</i> = 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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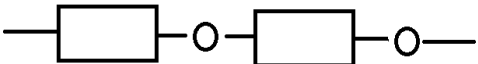
Question	Answer	Marks
4(c)(i)	$\text{CH}_2=\text{CHCH}_3$ double bond is shown; rest of structure correct;	2
4(c)(ii)	ester;	1
4(c)(iii)	(carboxylic) acid; alcohol;	1 1
4(d)	addition – polymer only product/only one product; condensation – (polymer and) simple molecule/water/ hydrogen chloride made; polymer 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 $\text{C}_2\text{H}_3\text{O}$; correct answer with no working = [2]	1 1
5(a)(iii)	M1 (86/)/43; M2 $\text{C}_4\text{H}_6\text{O}_2$; correct answer with no working = [2]	1 1
5(b)(i)	unsaturated / $\text{C}=\text{C}$ double bond / alkene;	1
5(b)(ii)	(organic / carboxylic) acid / contains or releases H^+ ions;	1
5(b)(iii)	$\text{CH}_3\text{CH}=\text{CHCOOH}$ / $\text{CH}_2=\text{CHCH}_2\text{COOH}$ / $\text{CH}_2=\text{CH}(\text{CH}_3)\text{COOH}$;	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)	<i>prediction:</i> 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; <i>explanation:</i> 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