



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY (US)

0439/41

Paper 4 Extended Theory

October/November 2016

MARK SCHEME

Maximum Mark: 80

Published

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Page 2	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0439	41

Question	Answer	Marks
1(a)	H	1
1(b)	G	1
1(c)	filtration	1
1(d)	fractional distillation	1 1
1(e)	add / mix / stir / dissolve / shake / heat with water filter / decant heat (filtrate) or (leave filtrate to) evaporate	1 1 1
1(f)	electrons (electrons) move / flow (throughout structure)	1 1

Question	Answer	Marks
2(a)(i)	melt(ing)	1
2(a)(ii)	sublimation / sublime	1
2(a)(iii)	condensing / condensation	1
2(b)	overcome / break the attractive forces	1
2(c)	E AND particles hit the walls (of the container) more often	1

Page 3	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0439	41

Question	Answer	Marks
3(a)(i)	heated / evaporated / boiled	1
3(a)(ii)	any 2 from: (O is) more viscous / thicker (O is) darker (O has) longer / bigger molecules / more carbon atoms (O has a) higher boiling point OR melting point (O is) less flammable	2
3(b)	any 2 from: similar / same chemical properties same functional group trend / pattern in physical properties (neighbouring members) differ by CH ₂ common methods of preparation	2
3(c)	any 2 structures from: pentane methylbutane dimethylpropane	2
3(d)	correct structure with any number from 1 to 6 of the hydrogen atoms replaced by chlorine atoms	1
3(e)(i)	(ends in) ene	1
3(e)(ii)	M1 88.24 / 12 AND 11.76 / 1 M2 7.353 / 7.353 (= 1) AND 11.76 / 7.353 = (1.6) M3 C ₅ H ₈	1 1 1
3(e)(iii)	relative molecular mass	1

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0439	41

Question	Answer	Marks
4(a)(i)	$\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ M1 formulae M2 balancing	2
4(a)(ii)	(nitrogen) air / atmosphere (hydrogen) steam / water / hydrocarbons / natural gas	1 1
4(a)(iii)	(temperature) answer in range 370–470 °C (pressure) answer in range 150–300 atm	1 1
4(b)(i)	M1 forward and reverse reactions (occur) M2 amounts / moles / concentrations (of reagents and products) constant OR M2 rate of forward and reverse reactions equal	1 1
4(b)(ii)	<u>endothermic</u> AND yield increases as temperature increases	1
4(b)(iii)	M1 yield decreases (as pressure increases) M2 because more moles / molecules (of gas) on the right M3 so position of equilibrium moves left	1 1 1

Page 5	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0439	41

Question	Answer	Marks
5(a)	(gas) oxygen (test) glowing splint (result of test) relights	1 1 1
5(b)	reference to ions / ionic ions cannot move in solid OR are in fixed positions in solid ions can move when in solution	1 1 1
5(c)(i)	copper ions / Cu^{2+} gain of electrons / oxidation number decreases	1 1
5(c)(ii)	any 3 from: anode decreases (in mass) copper removed (from anode) / solid (copper from anode) becomes aqueous cathode increases (in mass) copper deposited / added / Cu^{2+} deposited as Cu (on cathode)	3
5(c)(iii)	copper is both added and removed (at same rate) OR the concentration (of copper ions) does not change	1

Question	Answer	Marks
6(a)	large / big molecule made from (many) monomers (joined together)	1 1
6(b)(i)	amide / peptide	1
6(b)(ii)	(can be) broken down by microbes / bacteria	1 1
6(b)(iii)	starch / cellulose / DNA / RNA / polysaccharides /	1

Page 6	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0439	41

Question	Answer	Marks
6(c)(i)	M1 at least one correct ester linkage between boxes	1
	M2 at least two boxes shown and sufficient correct C and O atoms to make two correct ester linkages	1
	M3 continuation bond(s) AND if more than one repeat unit is shown, the repeat unit must be correctly identified	1

Question	Answer	Marks
7(a)	0.025	1
	M1 50 / 1000 (=0.05) M2 (0.05 × 0.5) = 0.025	1
7(b)	0.0125	1
7(c)	0.55	1
	M1 44 M2 0.55	1
7(d)	0.3	1

Page 7	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0439	41

Question	Answer	Marks
8(a)(i)	any 4 from: slowed down acid became less concentrated OR fewer particles per unit volume fewer collisions per second OR lower collision rate (then the reaction) stopped all the hydrochloric acid reacted	4
8(a)(ii)	any 4 from: faster (reaction) (powder has) larger surface area more collisions per second OR higher collision rate same volume of gas amount / moles hydrochloric acid is not changed	4
8(b)	any 5 from: temperature increased particles have more energy (particles) move faster more collisions per second OR higher collision rate more particles have sufficient energy to react / activation energy more of the collisions are successful	5