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CHEMISTRY **0620/41**

Paper 4 Extended Theory **October/November 2016**

MARK SCHEME

Maximum Mark: 80

Published

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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**

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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_5H_8	**1** **1** **1**
3(e)(iii)	relative molecular mass	**1**

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Question	Answer	Marks
4(a)(i)	$N_2 + 3H_2 \rightleftharpoons 2NH_3$ **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)	endothermic **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**

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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**

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

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

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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**

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