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CHEMISTRY **0620/33**

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

MARK SCHEME

Maximum Mark: 80

Published

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Question	Answer	Marks
1(a)(i)	O / oxygen	**1**
1(a)(ii)	Li / lithium	**1**
1(a)(iii)	Cr / chromium	**1**
1(a)(iv)	Br / bromine	**1**
1(a)(v)	Ar / argon	**1**
1(b)	titanium lowest density strong / resistant to corrosion	**1** **1** **1**

Question	Answer	Marks
2(a)(i)	phosphate / PO_4^{3-}	**1**
2(a)(ii)	sulfate	**1**
2(a)(iii)	0.5 (g)	**1**
2(b)	*test:* aluminium / magnesium / Devarda's alloy sodium hydroxide / strong alkali (and warm) *result:* gas given off turns (red) litmus blue	 **1** **1** **1**
2(c)(i)	filtration / filter	**1**
2(c)(ii)	carbohydrate **AND** protein	**1**
2(c)(iii)	random / zigzag / go anywhere / irregular	**1**

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Question	Answer	Marks
2(d)(i)	any 2 from: • improve growth of plants • increase protein (in plants) • fertilisers add nitrogen / nitrates / phosphorous / phosphates / potassium • to put back nitrogen / nitrates / phosphorous / phosphates / potassium into the soil	**2**
2(d)(ii)	ammonia is produced / formed (ammonia) is a gas	**1** **1**

Question	Answer	Marks
3(a)	*conditions required for ethanol manufacture by fermentation* (max = [3]) • uses yeast • uses glucose / sugar(s) • anaerobic / no oxygen present • room temperature / quoted temperature between 10 (°C)–40 (°C) (inclusive) • aqueous conditions / water needed • pH 7 / near pH 7 / neutral *conditions required for ethanol manufacture by hydration of ethene* (max = [3]) • uses high temperature / heat • uses a catalyst • uses high pressure • uses water / steam *equation* (max = [2]) • ethene + water / steam → ethanol • glucose → ethanol + carbon dioxide	**5**

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Question	Answer	Marks
3(b)(i)	Liquid room temperature is between the melting point and boiling point (of methanol) / room temperature is above the melting point but below the boiling point (of methanol)	**1** **1**
3(b)(ii)	values between 125(°C)–145 (ºC) inclusive	**1**
3(b)(iii)	increases with (increasing) number of carbon atoms	**1**
3(c)(i)	structure of ethanol showing all of the atoms and all of the bonds OH instead of O─H and rest of structure correct = [1]	**2**
3(c)(ii)	any suitable use, e.g. fuel / sterilisation / antiseptic solvent / making a named chemical, e.g. ethanoic acid /	**1**

Question	Answer	Marks
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)	*in pure water:* blue *in a strongly acidic solution:* yellow	**1** **1**
4(c)(i)	**A** (volumetric) pipette **B** burette	**1** **1**
4(c)(ii)	add (a few drops of) indicator to the flask slowly add acid (from the burette) into the alkali (until indicator) changes colour / until (alkali) neutralised / until neutral	**1** **1** **1**

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Question	Answer	Marks
5(a)(i)	endothermic because heating is needed	**1**
5(a)(ii)	arrow(s) pointing in both directions / ⇌	**1**
5(b)(i)	**C** in or just outside the tube at the top left **L** in or just outside the tube at the bottom right	**1** **1**
5(b)(ii)	to produce a high temperature / for heat(ing)	**1**
5(c)	any 2 from: • plants / crops do not grow well if the soil is too acidic • increases the pH of the soil / makes the soil less acidic • neutralises the acid	**2**
5(d)(i)	*test:* (aqueous) barium chloride / (aqueous) barium nitrate *result:* white precipitate / white solid	**1** **1**
5(d)(ii)	SiO_2 / Si_6O_{12}	**1**
5(e)(i)	pH 12	**1**
5(e)(ii)	H_2O	**1**
5(e)(iii)	any 3 from: • (limewater absorbs) carbon dioxide • (carbon dioxide) from the air • carbon dioxide dissolves in limewater • carbon dioxide (solution) is slightly acidic / carbon dioxide is an acidic oxide • idea that carbon dioxide reacts with / neutralises calcium hydroxide / neutralises limewater / neutralises the solution • pH (of limewater / solution) falls / pH goes down • calcium carbonate is formed	**3**

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Question	Answer	Marks
6(a)(i)	(in order of their) atomic number / proton number	**1**
6(a)(ii)	less metallic across a period / metals on left of Periodic Table and non-metals on right of Periodic Table / electrical conductivity decreases / pattern in melting (or boiling) points (increases to a maximum then decreases)	**1**
6(a)(iii)	any 2 from: • density increases • melting / boiling point decreases • hardness decreases • reactivity increases	**2**
6(b)(i)	*from:* colourless / (light) green *to:* brown	**1** **1**
6(b)(ii)	iodine is more reactive than astatine **ORA**	**1**
6(c)(i)	H_2 (on left) 2(HC*l*) (on right)	**1** **1**
6(c)(ii)	one pair of bonding electrons between H and C*l* 6 non-bonding electrons around C*l* and none around H	**1** **1**
6(c)(iii)	lithium chloride water	**1** **1**

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Question	Answer	Marks
7(a)	**A** condensation / condensing / condense **B** freezing / solidification	**1** **1**
7(b)	*arrangement:* regular *motion:* (only) vibrating / not moving (from place to place)	**1** **1**
7(c)	<u>acidic</u> because phosphorous is a non-metal / phosphorous is on the right-hand side of the Periodic Table	**1**
7(d)	any 2 from: • does not conduct electricity / heat • has a low melting point / boiling point • insoluble in water / soluble in organic solvents	**2**
7(e)	sulfur dioxide is produced harmful effect of sulfur dioxide, e.g. acid rain / named effect of acid rain, e.g. corrodes metals / death of trees / kills organisms in lakes / irritation to lungs (or eyes / skin / nose / throat) /	**1** **1**

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