Cambridge
O Level

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Cambridge Ordinary Level

**CHEMISTRY** **5070/21**

Paper 2 Theory **October/November 2016**

MARK SCHEME

Maximum Mark: 75

**Published**

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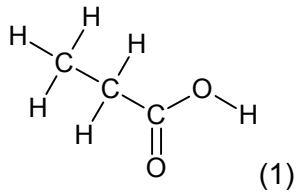


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| Question | Answer | Mark |
|---|---|---|
| A1(a) | NO / nitrogen oxide / nitric oxide (1) | 1 |
| A1(b) | $CH_4$ / methane (1) | 1 |
| A1(c) | $Ba(NO_3)_2$ / barium nitrate (1) | 1 |
| A1(d) | $V_2O_5$ / vanadium pentoxide / vanadium(V) oxide (1) | 1 |
| A1(e) | CaO / calcium oxide (1) | 1 |
| | **Total:** | **5** |

| Question | Answer | Mark |
|---|---|---|
| A2(a)(i) | acid that is completely ionised / acid that is completely dissociated / acid that releases all ionisable hydrogen (1) | 1 |
| A2(a)(ii) | add Universal Indicator AND compare colour with pH (colour) chart (1) | 1 |
| A2(b) | add calcium oxide / add lime / add calcium hydroxide / add calcium carbonate (1)<br>base (reacts with the acid) / neutralising (the acid) (1) | 2 |
| A2(c) | rate increases as pH increases (then remains constant) (1) | 1 |
| | **Total:** | **5** |

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| Question | Answer | Mark |
|---|---|---|
| A3(a) | $C_8H_{18}O$ (1) | **1** |
| A3(b)(i) | increases with increased number of carbon atoms (1) | **1** |
| A3(b)(ii) | values between 0.806 and 0.813 (inclusive) (1) | **1** |
| A3(b)(iii) | liquid<br>because melting point is below room temperature and boiling point is above room temperature (1) | **1** |
| A3(c) | (viscosity) increases as number of C atoms increases / increases down the alcohols (1)<br>any correct answer related to length / size / mass of molecule e.g. size of molecule increases / length of carbon chain increases / chains get more tangled / van der Waals' forces increase / intermolecular forces increase (1) | **2** |
| A3(d) | $C_3H_7OH + 4½O_2 \rightarrow 3CO_2 + 4H_2O$<br>correct formulae for reactants and products (1)<br>correct balancing, dependent on correct formulae (1) | **2** |
| A3(e)(i) | (acidified) potassium manganate(VII) / potassium permanganate (1)<br>heat / reflux (1) | **2** |
| A3(e)(ii) |  (1) | **1** |
| | **Total:** | **11** |

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| Question | Answer | Mark |
|---|---|---|
| A4(a) | peroxodisulfate: increases rate / doubling concentration doubles the rate (1)<br>iodide: increases rate / doubling concentration doubles the rate (1) | **2** |
| A4(b) | lower the activation energy (1) | **1** |
| A4(c)(i) | oxidation number of iron decreases / they gain electrons / iron(III) gets reduced (1) | **1** |
| A4(c)(ii) | yellow → brown (1) | **1** |
| A4(c)(iii) | add (aqueous) sodium hydroxide / add (aqueous) ammonia (1)<br>red-brown precipitate (1) | **2** |
| A4(d) | $2Fe^{2+} + S_2O_8^{2-} \rightarrow 2Fe^{3+} + 2SO_4^{2-}$ (1) | **1** |
| | **Total:** | **8** |

| Question | Answer | Mark |
|---|---|---|
| A5(a) | 39% (2)<br>If 2 marks not scored, molar mass of $KClO_3 = 122.5$ scores 1 mark | **2** |
| A5(b) | $KClO_3 = \frac{12.25}{122.5}$ OR 0.10 (mol) (1)<br><br>moles $O_2 = 1.5 \times 0.01 = 0.15$ moles / idea of multiplying moles by 1.5 (1)<br>volume of $O_2 = 3.6\,dm^3$ / 3600 $cm^3$, correct unit must be included (1) | **3** |

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| Question | Answer | Mark |
|---|---|---|
| A5(c)(i) | potassium (atom(s)) loses electron(s) (1)<br>chlorine (atom(s)) gains electron(s) (1)<br>so there are 8 electrons in outer shells of both ions (1) | **3** |
| A5(c)(ii) | One mark each for any **two** of :<br>• high melting point / high boiling point<br>• dissolves in water<br>• does not conduct electricity when solid / conducts electricity when molten | **2** |
| | **Total:** | **10** |

| Question | Answer | Mark |
|---|---|---|
| A6(a) | nitrogen 78% AND oxygen 21% (1) | **1** |
| A6(b)(i) | correct 'dot-and-cross' diagram with two pairs of bonding electrons and four non-bonding electrons on each of the two oxygen atoms (1) | **1** |
| A6(b)(ii) | Ar (1) | **1** |
| A6(c) | argon is unreactive / argon is inert / argon does not react (1)<br><br>air would react with sodium / air would react with titanium / air would react with the reaction mixture / argon prevents sodium reacting with air / argon stops titanium reacting with air / to exclude air (1) | **2** |
| A6(d) | any suitable e.g. lamps / bulbs / lasers (1) | **1** |
| | **Total:** | **6** |

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| Question | Answer | Mark |
|---|---|---|
| B7(a) | reactants labelled on left and products labelled on right AND product level below reactant level (1)<br>enthalpy change labelled and shown by downward arrow (1)<br>activation energy as upward arrow from left hand energy level to energy 'hump' above the highest energy level of both products and reactant (1) | **3** |
| B7(b) | bromine water / aqueous bromine / bromine (1)<br>turns colourless (1) | **2** |
| B7(c) | $Cu + \mathbf{4}HNO_3 \rightarrow Cu(NO_3)_2 + \mathbf{2}H_2O + \mathbf{2}NO_2$ (1) | **1** |
| B7(d) | $OCOCH_3$<br>\|<br>$CH{-}CH_2$ (1)<br><br>extension bonds shown (1) | **2** |
| B7(e) | One mark each for any **two** suitable points e.g. :<br><br>• fills landfill sites<br>• litter<br>• when burnt greenhouse gases given off / burning produces poisonous gases<br>• get caught in birds / fish gullets (causing choking / death) | **2** |
| | **Total:** | **10** |

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| Question | Answer | Mark |
|---|---|---|
| B8(a) | One mark each for any **two** of :<br><br>• catalyst / phosphoric acid<br>• high temperature / heat<br>• high pressure | **2** |
| B8(b)(i) | % yield decreases as temperature increases (1)<br>reaction is exothermic / reaction releases energy (1)<br>(equilibrium) moves to the left (1) | **3** |
| B8(b)(ii) | at 200 ºC rate of reaction will be low / slow reaction at 200 ºC / 300 ºC rate of reaction will be high / fast reaction at 300 ºC (1)<br>idea of compromise temperature / idea of balance between lower yield and faster rate (1) | **2** |
| B8(c) | position of equilibrium shifts to the right / equilibrium moves towards the product side (1)<br>more molecules on left than right / more moles of on left than on right (1) | **2** |
| B8(d) | $HCO_2H + C_2H_5OH \rightarrow HCO_2C_2H_5 + H_2O$ (1) | **1** |
| | **Total:** | **10** |

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| Question | Answer | Mark |
|---|---|---|
| B9(a) | One mark each for any **two** suitable properties e.g.:<br>• shiny<br>• conducts heat / conducts electricity<br>• malleable<br>• ductile | **2** |
| B9(b) | 2 electrodes dipping into liquid and connected to a power supply (1)<br>electrolyte labelled as aqueous silver ions, soluble silver compound or named soluble silver compound / silver nitrate solution (1)<br>silver anode / silver positive electrode AND tin cathode / tin negative electrode (1) | **3** |
| B9(c) | mol Sn = $\frac{5.95}{119}$<br>mol C$l$ = $\frac{3.55}{35.5}$<br>dividing masses by correct atomic masses (1)<br>(mol Sn = 0.05 and mol C$l$ = 0.1) formula is Sn$Cl_2$ (1) | **2** |
| B9(d) | mol tin(II) oxide = $\frac{13.5}{135}$ OR 0.10 mol (1)<br>mass tin(IV) oxide expected = $0.10 \times 151 = 15.1$ g (1)<br>% yield = $\frac{12.7}{15.1} \times 100$ = 84% (1) | **3** |
| | **Total:** | **10** |

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| Question | Answer | Mark |
|---|---|---|
| B10(a) | add acid to alkali in flask with indicator and record volume of acid needed (to neutralise alkali) (1)<br>repeat without indicator adding the recorded volume of acid (1)<br>evaporate solution to point of crystallisation / leave to crystallise (1)<br>filter off crystals and dry with filter paper / leave in a drying oven (1) | **4** |
| B10(b) | mol LiOH = $0.500 \times \frac{20}{1000}$ OR 0.01 mol<br>molar mass of hydrated lithium nitrate = 123 (1)<br>mass = $123 \times 0.01 = 1.23$ g (1) | **3** |
| B10(c) | brown fumes / colourless liquid condensing at mouth of tube / white solid forming (1) | **1** |
| B10(d) | ions (are free to) move (1) | **1** |
| B10(e) | anode: oxygen / $O_2$ AND cathode lithium / Li (1) | **1** |
| | **Total:** | **10** |

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