Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CHEMISTRY **5070/22**

Paper 2 Theory **May/June 2016**

MARK SCHEME

Maximum Mark: 75

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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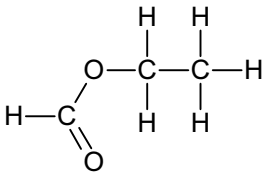
Question	Answer	Marks
A1(a)	**C** and **H** (1)	**1**
A1(b)	**B** (1)	**1**
A1(c)	Addition – **B** / **E** / **F** / **I** **AND** Condensation – **A** / **C** / **D** / **G** / **H** (1)	**1**
A1(d)	**B** / **E** (1)	**1**
A1(e)	**G** (1)	**1**
	Total	**5**

Question	Answer	Marks
A2(a)	**1 mark for any one of:** • Low melting point / low boiling point • Does not conduct electricity • Does not conduct heat	**1**
A2(b)(i)	$HF \rightarrow H^+ + F^-$	**1**
A2(b)(ii)	Hydrogen ion(s) / H^+ present	**1**
A2(c)	Moles of HF = 0.01 (1) Moles of $Ca(OH)_2$ = 0.005 / moles of $Ca(OH)_2$ = 0.5 × moles of HF (1) Volume = 33.3 cm^3 (1)	**3**
A2(d)(i)	**1 mark each for any two of:** • High melting point / high boiling point • Does not conduct electricity as a solid • Soluble in water • Conducts electricity as a molten liquid	**2**
A2(d)(ii)	Magnesium (atom) loses 2 electrons (1) Fluorine (molecule) gains 2 electrons / each fluorine atom gains an electron (1)	**2**
	Total	**10**

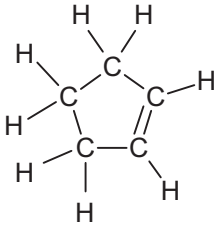
Question	Answer	Marks
A3(a)	 (1)	1
A3(b)(i)	Changing of a liquid into a gas / changing liquid to vapour (happening at any temperature) (1)	1
A3(b)(ii)	Molecules have less energy / molecules move slower (1) Molecules don't have enough energy to overcome force between molecules / molecules don't have enough energy to escape (into the air) (1)	2
A3(b)(iii)	Pentyl ethanoate / $CH_3CO_2C_5H_{11}$ (1) High**est** relative formula mass (1)	2
	Total	6

Question	Answer	Marks
A4(a)	**All three** conditions correct (2 marks) **Two** correct conditions (1 mark) Temperature 350 to 500 °C Pressure 1 to 10 atmospheres Catalyst vanadium(V) oxide / vanadium pentoxide / V_2O_5	2
A4(b)	Rate of reaction increases **AND** particles closer together / more particles per unit volume / more crowded particles (1) More collisions per second / increased collision frequency / particles collide more often (1)	2
A4(c)	Reduces the cost of the process / (allows reactions to be carried out at) lower temperatures / (allows reactions to be carried out at) lower pressures	1
A4(d)	Relative formula mass = 174 (1) Percentage of K = 44.8% (1)	2
	Total	7

Question	Answer	Marks
A5(a)	sodium magnesium zinc **cobalt** silver Sodium, magnesium, zinc and silver in correct order (ignore cobalt) (1) **Cobalt** between zinc and silver as shown above (1)	**2**
A5(b)	$CoO + Mg \rightarrow MgO + Co$ (1)	**1**
A5(c)	(Thermally) decomposes / cobalt oxide formed / carbon dioxide formed / $CoCO_3 \rightarrow CoO + CO_2$	**1**
A5(d)	Attraction between sea of electrons and (positive) ions / forces between sea of electrons and (positive) ions (1) Attraction is very strong / force is very strong / it takes a lot of energy to overcome these strong forces (1) (second mark dependent on attraction between ions and electrons / forces between ions and electrons)	**2**
A5(e)	$^{59}_{27}Co$ (1)	**1**
	Total	**7**

Question	Answer	Marks
A6(a)	Correct 'dot-and-cross' diagram for carbon dioxide (1)	**1**
A6(b)(i)	From fields / from farms / fertilisers (1)	**1**
A6(b)(ii)	**1 mark each of any three from:** • Eutrophication • Increased growth of algae / algal bloom / fast growth of algae • This blocks out sunlight / plants can't photosynthesise • Plants (beneath the surface) die **AND** get decomposed by bacteria that use up oxygen • Other aquatic organisms die because of lack of oxygen	**3**
A6(c)	Chlorination – kills bacteria or microbes (1) Filtration – removes insoluble materials / removes solid / removes named solid (1) Use of carbon – removes odours / removes (unpleasant) tastes (1)	**3**
A6(d)(i)	Weak intermolecular forces / weak forces between molecules / weak intermolecular bonds / weak attractive forces between molecules / not much energy needed to overcome intermolecular forces (1)	**1**
A6(d)(ii)	Add universal indicator and it will turn green / add full range indicator and it will turn green / add pH paper and it turns green (1)	**1**
	Total	**10**

Question	Answer	Marks
B7(a)	**1 mark each of any four from:** • Use of **excess** lead(II) oxide • Use of nitric acid • Warm the solution / use warm / hot nitric acid • Filter mixture to get the solution • Evaporate some of the solution and leave / leave to crystallise / warm to crystallisation point / leave on window sill (to crystallise) / evaporate solution then cool	4
B7(b)	$Pb^{2+}(aq) + 2I^{-}(aq) \rightarrow PbI_2(s)$ Correct formulae and balance (1) State symbols – dependent on correct formulae (1)	2
B7(c)(i)	Cathode – hydrogen / H_2 (1) Anode – oxygen / O_2 (1)	2
B7(c)(ii)	$2H^{+} + 2e^{-} \rightarrow H_2$	1
B7(d)	$2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$	1
	Total	10

Question	Answer	Marks
B8(a)(i)	Contains (one or more) carbon-carbon double bond / contains C=C bond	1
B8(a)(ii)	Contains only carbon and hydrogen / contains carbon and hydrogen and no other element	1
B8(b)	$2C_6H_{10} + 17O_2 \rightarrow 12CO_2 + 10H_2O$ (1)	1
B8(c)(i)	$C_6H_{10}Br_2$ (1)	1
B8(c)(ii)	(bromine / solution) goes colourless / decolourised (1)	1
B8(d)	Moles of C_6H_{14} = 3.0 (1) Mass of C_6H_{12} = 246 (1)	2
B8(e)(i)	Mole ratio C: H = 7.35 : 11.8 (1) Idea of dividing by smallest / simplest ratio is 1 : 1.6 **AND** × 5 (1)	2
B8(e)(ii)	 (1)	1
	Total	10

Question	Answer	Marks
B9(a)	Bond breaking absorbs energy **and** bond making releases energy / bond breaking is endothermic **and** bond making is exothermic (1) Less energy absorbed than released / more energy released than absorbed / endothermic energy change is less than exothermic energy change / exothermic energy change is more than endothermic energy change (1)	**2**
B9(b)	Moles of methanol = 5 (1) Energy released = 455 kJ (1)	**2**
B9(c)(i)	Position of equilibrium moves to the right / equilibrium shifts to the product side (1) Fewer moles on product side / more moles on reactant side / greater volume (of gas) on left ORA / greater number of molecules on the left ORA (1)	**2**
B9(c)(ii)	Position of equilibrium moves to the left / equilibrium shifts to the reactant side (1) Reaction is exothermic / forward reaction is exothermic / backward reaction is endothermic (1)	**2**
B9(d)(i)	Butanoic acid (1)	**1**
B9(d)(ii)	(Mineral) acid (1)	**1**
	Total	**10**

Question	Answer	Marks
B10(a)	Chloride ions lose electrons / oxidation state of chlorine increases or gets more positive / oxidation state (of chlorine) goes from –1 to 0 / the chloride loses hydrogen (1)	1
B10(b)	Idea that manganese(IV) oxide is limiting reagent / HC*l*(aq) is in excess (1) The volume of gas is proportional to the mass of MnO_2 / As the mass of MnO_2 increases, the volume of gas increases / There is a positive correlation between (the mass of) MnO_2 and the (volume of) chlorine (1)	2
B10(c)	1.20 (1)	1
B10(d)	Iron(II) chloride gives a green precipitate / Iron(II) chloride gives a grey-green precipitate (1) Iron(III) chloride gives a brown precipitate (1) $Fe^{2+} + 2OH^- \rightarrow Fe(OH)_2$ / $FeCl_2 + 2NaOH \rightarrow Fe(OH)_2 + 2NaCl$ (1) $Fe^{3+} + 3OH^- \rightarrow Fe(OH)_3$ / $FeCl_3 + 3NaOH \rightarrow Fe(OH)_3 + 3NaCl$ (1)	4
B10(e)	(Moist blue or red) litmus paper (1) Bleached / goes white (1)	2
	Total	**10**