

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge Ordinary Level

MARK SCHEME for the October/November 2015 series

5070 CHEMISTRY

5070/21

Paper 2 (Theory), maximum raw mark 75

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A1 (a) argon (1) [1]

(b) chlorine/sulfur dioxide (1) [1]

(d) ammonia (1) [1]

(c) ethene (1) [1]

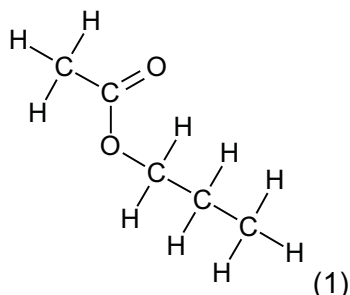
(e) nitrogen(II) oxide (1) [1]

(f) oxygen (1) [1]

[Total: 6]

A2 (a) three pairs of bonding electrons between H and N (1) [2]
two non-bonding electrons on N (1)

(b) propyl ethanoate (1) [2]



(c) [2]

	C	H	O
mole ratio	$\frac{76.60}{12}$ / 6.38	$\frac{6.38}{1}$ / 6.38	$\frac{17.02}{16}$ / 1.064
simplified ratio	$\frac{6.38}{1.064}$ / 6	$\frac{6.38}{1.064}$ / 6	$\frac{1.064}{1.064}$ / 1

mole ratio line (1)

simplified ratio or empirical formula (1)

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(d) (i) sulfur dioxide/SO₂ (1) [2]
(sulfur dioxide) dissolves and is oxidised/ reacts with (rain)water and oxygen (1)

(ii) any suitable example e.g. reacts with mortar/ reacts with limestone/ erodes buildings (made of carbonate rocks)/ corrodes metalwork etc. (1) [1]

(iii) C₆H₁₂O₆ + 6O₂ → 6CO₂ + 6H₂O [2]

correct reactants and formulae (1)

correctly balanced equation (1)

[Total: 11]

A3 (a) (i) chlorofluorocarbons/CFCs (1) [1]

(ii) ozone absorbs uv (radiation) (1) [2]

too much uv increases incidence of skin cancer/cataracts etc. (1)

(b) (i) reaction catalysed by light/light involved in breakdown of chemicals (1) [1]

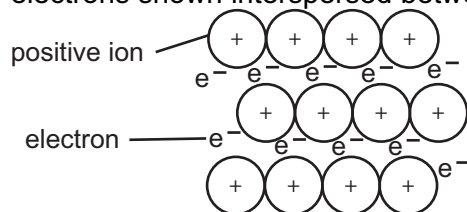
(ii) 2O₃ → 3O₂ (1) [1]

(c) 2Fe²⁺ + 2H⁺ + O₃ → 2Fe³⁺ + H₂O + O₂ (1) [1]

[Total: 6]

A4 (a) positive ions in regular layers with a minimum of two layers of ions (1) [2]

electrons shown interspersed between the particles shown (1)



Marks can be awarded from correct description in writing or from labelled diagram.

(b) idea of layers of metal atoms/or ions (1) [2]

can slide over each other (when force applied) (1)

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- (c) (i) correct M_r of 128 **or** (2×64) as numerator of fraction [2]
OR
 correct M_r $(2 \times 64) + 12 + (16 \times 5) + (2 \times 1)$ **or** 222 as denominator (1)
 percentage = $57.65/57.7$ (1)

- (ii) add acid (1) [2]
 gas evolved turns limewater milky (1)

- (d) **A** is oxidation because electrons are lost (1) [2]
B is reduction because electrons are gained (1)

[Total: 10]

- A5 (a) (i) ANY FOUR FROM:** [4]

ammonia molecules/HBr molecules have enough energy to escape from the HBr(aq) or NH_3 (aq) (1)

diffusion (1)

molecules move randomly/molecules spread out/molecules get mixed up (1)

move from high to low concentration/move with the concentration gradient (1)

solid formed where NH_3 and HBr react (1)

HBr has higher M_r than NH_3 /molecules of HBr are heavier than molecules of NH_3 (1)

NH_3 molecules move faster than HBr molecules/ NH_3 diffuses faster (1)

- (b) higher pressure pushes molecules closer together [1]

[Total: 5]

- A6 (a) mol of NaOH = 0.30 (1)** [2]

energy released $(= 0.30 \times 57.1) = 17/17.1(3)(\text{kJ})$ (1)

- (b) mol of HCl = $2.19/36.5$ **OR** $= 0.06$ (1) [2]
 volume = $(0.06/0.2) = 0.3 \text{ dm}^3/300 \text{ cm}^3$ (1)

- (c) add nitric acid and silver nitrate (1) [2]
 white precipitate/white solid formed (1)

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(d) amphoteric (1) [1]

[Total: 7]

B7 (a) weak forces between layers / (weak) van der Waals' forces between layers (1) [2]

layers slide over each other (easily) (1)

(b) 5 protons **and** 6 neutrons (1) [1]

(c) giant structure / lattice (1) [2]

(all) bonds are strong / lot of energy needed to break the bonds / needs high temperature to break the bonds (1)

(d) (i) has delocalised electrons / free electrons / electrons can move (1) [1]

(ii) inert / does not react (with the electrolyte) (1) [1]

(e) (i) $4\text{OH}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^-$ (1) [1]

(ii) $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$ (1) [1]

(iii) the mole ratio of H to O in water is 2:1 / for every 2 moles of hydrogen produced only 1 mole of oxygen is liberated (1) [1]

[Total: 10]

B8 (a) (i) mol Mg (= $0.030/24$) = 1.25×10^{-3} (1) [3]
mol HCl (= $0.10 \times 20/1000$) = 2×10^{-3} (1)

mol HCl required to react with 1.25×10^{-3} mol Mg is
 2.5×10^{-3} **so** Mg in excess (1)

(ii) bubbles / effervescence / fizzing / tube gets hot / magnesium reduces on size (1) [1]

(b) mol of gas (= $24/24\,000$) = 1.0×10^{-3} (1) [2]
mass of hydrogen (= $2 \times 1.0 \times 10^{-3}$) = 2.0×10^{-3} (g)

(c) greater surface area (1) [2]

more frequent collisions (of H^+ ions with Mg) (1)

(d) (i) $3\text{Mg(s)} + \text{N}_2\text{(g)} \rightarrow \text{Mg}_3\text{N}_2\text{(s)}$ (1) [1]

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(ii) 3 – / –3 (1) [1]

[Total: 10]

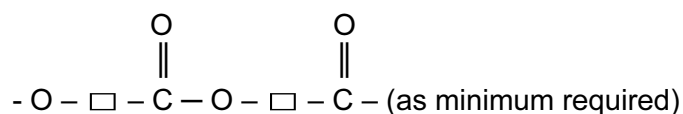
B9 (a) arrangement: regularly arranged / in a set pattern / ordered / not random / fixed position (1) [2]

motion: vibrating / do not move (from place to place) (1)

(b) (i) condensation (polymer) (1) [1]

(ii) correct structure with minimum of two units (2) [2]

e.g.



(c) (i) moles methanal ($= 1800/30$) = 60 mol (1) [3]
 mass of glycolic acid ($= 60 \times 76$) = 4560 (g) (1)
 for 45% yield ($= 4560 \times 45/100$) = 2052 (g) (1)

(ii) strong acid is fully ionised / fully dissociated in solution (1) [2]

weak acid is partially ionised / incompletely dissociated in solution (1)

[Total: 10]

B10(a) position of equilibrium moves to right / more products formed (1) [2]

goes in direction of decreasing number of moles / goes in direction of smaller volume / fewer moles of products than reactants (1)

(b) position of equilibrium goes to the right / more products formed (1) [2]

reaction is exothermic / backward reaction is endothermic / reaction goes to the exothermic direction (1)

(c) particles move slower / particles have less energy (1) [2]

fewer particles have activation energy / fewer successful collisions / fewer fruitful collisions (1)

(d) (i) speeds up reaction (1) [2]

by lowering the activation energy / providing an alternative reaction pathway (1)

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(ii) **ANY TWO FROM:**

[2]

form coloured compounds (1)

have variable oxidation states/form ions with different charges (1)

form complex ions (1)

[Total: 10]