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

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CAMBRIDGE
International Examinations

A1 **(a)** argon (1) [1]

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

(d) ammonia (1) [1]

(c) ethene (1) [1]

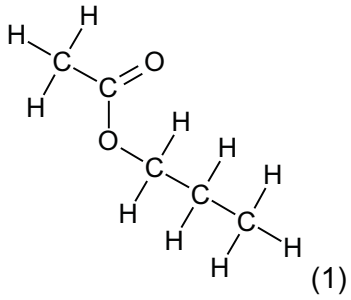
(e) nitrogen(II) oxide (1) [1]

(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]



(1)

(c) [2]

	C	H	0
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)

(d) (i) sulfur dioxide / SO_2 (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) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ [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]

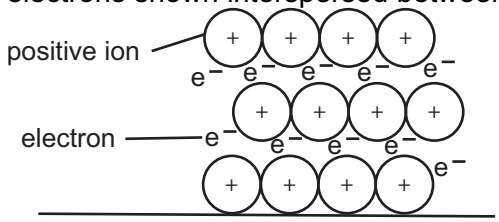
(ii) $2O_3 \rightarrow 3O_2$ (1) [1]

(c) $\mathbf{2}Fe^{2+} + \mathbf{2}H^+ + O_3 \rightarrow \mathbf{2}Fe^{3+} + H_2O + O_2$ (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)

(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 $(= 0.30 \times 57.1) = 17 / 17.1(3)$ (kJ) (1)

(b) mol of HC*l* = 2.19 / 36.5 **OR** = 0.06 (1) [2]
volume = (0.06 / 0.2) = 0.3 dm^3 / 300 cm^3 (1)

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

(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) $4OH^- \rightarrow O_2 + \mathbf{2H_2O + 4e^-}$ (1) [1]

(ii) $2H^+ + 2e^- \rightarrow H_2$ (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 HC*l* (= $0.10 \times 20 / 1000$) = 2×10^{-3} (1)

mol HC*l* 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) $3Mg(s) + N_2(g) \rightarrow Mg_3N_2(s)$ (1) [1]

(ii) 3– / –3 (1) [1]

[Total: 10]

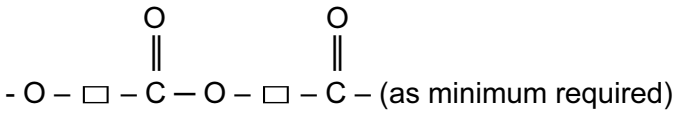
B9 (a) arrangement: regularly arranged / in a set pattern / ordered / not random / fixed position (1) [2]

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 × 76) = 4560 (g) (1)
for 45% yield (= 4560 × 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)

(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]