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

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

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

(d) ammonia (1) [1]

(c) ethene (1) [1]

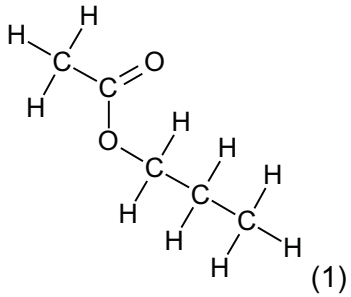
(e) nitrogen(II) oxide (1) [1]

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

(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]

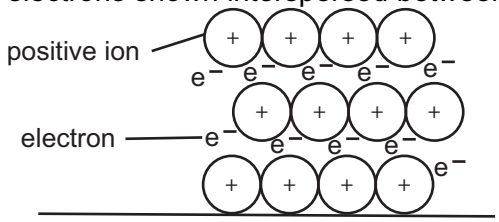
(ii) $2O_3 \rightarrow 3O_2$ (1) [1]

(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 (= 0.30×57.1) = 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)** $4OH^- \rightarrow O_2 + \mathbf{2H_2O} + \mathbf{4e^-}$ (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 × 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]

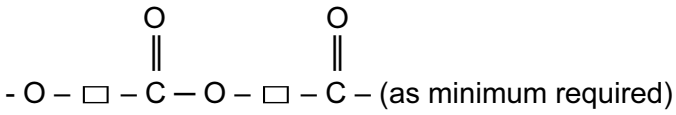
B9 **(a)** arrangement: regularly arranged / in a set pattern / ordered / not random / fixed position (1) [2]

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.



(as minimum required)

(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]