CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge Ordinary Level

MARK SCHEME for the May/June 2015 series

5070 CHEMISTRY

5070/22 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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A1 **(a)** **(i)** C (1) [1]

(ii) A (1) [1]

(iii) F (1) [1]

(iv) G (1) [1]

(b) A **AND** B / A **AND** G (1) [1]

[Total: 5]

A2 **(a)** Fluorine (1) [1]

(b) **(i)** 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]

(ii) Moles of chlorine = 1.5 (1)

Energy released = 277.5 (kJ) (1) [2]

(c) **(i)** Unchanged / does not move (1)

Same number of moles (of gas) on both sides / equal volumes (of gases) on both sides / equal number of molecules on both sides (of the equation) (1) [2]

(ii) Moves to the left / backward reaction favoured / moves to reactants / moves to H_2 or I_2 (1)

(Forward) reaction is endothermic / reverse reaction is exothermic (1) [2]

(d) **(i)** $HI \rightarrow H^+ + I^-$ (1)
OR
$H_2O + HI \rightarrow H_3O^+ + I^-$ (1) [1]

(ii) $Ca + 2HI \rightarrow CaI_2 + H_2$ [1]

(iii) $CO_3^{2-} + 2H^+ \rightarrow H_2O + CO_2$ (1)
OR
$CO_3^{2-} + 2H^+ \rightarrow H_2CO_3$ (1)
OR
$CO_3^{2-} + H^+ \rightarrow HCO_3^-$ (1) [1]

[Total: 12]

A3 **(a)** (Different) number of neutrons / (different) mass number / (different) nucleon number / phosphorus 32 has one extra neutron / atomic mass / mass (1)

(Same) number of protons / (same) atomic number / both have 15 protons (1) [2]

(b) P_4 (1) [1]

(c) **(i)** Weak intermolecular forces / weak attraction between molecules (1) [1]

(ii) No free electrons / no delocalised electrons / all electrons used in bonding / no mobile electrons(1) [1]

(d)

number of neutrons	**16** (1)
number of protons	**15** (1)
electronic configuration	**2,8,8** (1)

[3]

(e) All three shared pairs between H and P (1)

Rest of structure correct (1) [2]

(f) $2PH_3 + 4O_2 \rightarrow P_2O_5 + 3H_2O$
Correct formulae (1)
Balancing – dependent on correct formulae (1) [2]

[Total: 12]

A4 **(a)** **(i)** **B** is SO_2 (1) [1]

(ii)

	S	O
Mole ratio	$\frac{40}{32}$ **OR** 1.25	$\frac{60}{16}$ **OR** 3.75
Simplified ratio	1	3

Mole ratio line (1)
Empirical formula SO_3 (1)
Sulfur trioxide / sulfur(VI) oxide (1) [3]

(iii) Fe_2O_3 (1) [1]

(b) $Fe^{2+}(aq) + 2OH^-(aq) \rightarrow Fe(OH)_2(s)$
Equation (1)
State symbols – dependent on correct formulae (1) [2]

(c) Any soluble barium compound e.g. barium nitrate / barium chloride (1)

$BaSO_4$ (1) [2]

[Total: 9]

A5 (a) (i) $Mg^{2+} + 2e^- \rightarrow Mg$ (1)

$2Cl^- \rightarrow Cl_2 + 2e^-$ (1) [2]

(b) (i) Impure copper (1) [1]

(ii) Pure copper (1) [1]

(c) Moles of NaCl = 55 × 3.5 **OR** 192.5 (1)

Moles of Cl_2 = 96.25 / 96.3 / idea of dividing moles by 2 (1)

Volume = 2310 (dm^3) (1) [3]

[Total: 7]

B6 (a) white solid disappears / pungent smell / condensation / colourless droplets (1) [1]

(b) For ammonia:
Test with (moist red) litmus (1)
turns blue (1)
OR
Test (with stopper / glass rod from) (concentrated) HCl (1)
white smoke / white fumes(1)

For carbon dioxide:
Test with lime-water (1)
Goes milky / cloudy / white precipitate / goes white (1) [4]

(c) Add soluble zinc compound / zinc chloride / zinc sulfate / zinc nitrate / other named soluble zinc compound (1)

Filter (1)
NOTE: This mark can only be scored for filtration directly after mixing the reagents and implying that it is the solid that is on the filter paper

Wash and (air) dry residue (1) [3]

(d) $3(NH_4)_2CO_3 + 2H_3PO_4 \rightarrow 2(NH_4)_3PO_4 + 3CO_2 + 3H_2O$
Correct formulae (1)
Balancing – dependent on correct formulae (1) [2]

[Total: 10]

B7 **(a)** $TiCl_4 + 2Mg \rightarrow 2MgCl_2 + Ti$ (1) [1]

(b) Reduction because Ti ions gain electrons / oxidation number of Ti decreases (1)

Oxidation since Mg loses electrons / oxidation number of Mg increases (1) [2]

(c) M_r of $TiCl_4$ = 190 (1)

Moles of $TiCl_4$ is 0.658 / % of Ti = 25.3 (1)

Mass of Ti = 31.6 (g) (1) [3]

(d) Titanium because magnesium can displace titanium (1) [1]

(e) (Simple) molecular / reference to molecules (1)

Covalent (1) [2]

(f) Electron(s) can move / has delocalised electron(s) (1) [1]

[Total: 10]

B8 **(a)** Any correct equation e.g.
$C_{17}H_{36} \rightarrow C_3H_6 + C_{14}H_{30}$ (1) [1]

(b) reaction is faster because particles are moving faster / rate increases because particles have more energy (1)

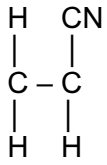
more particles have energy above the activation energy / more effective collisions / more fruitful collisions / more energetic collisions / more (chance of) successful collisions (1) [2]

(c) **(i)** Has carbon-carbon double bond / has C=C bond (1) [1]

(ii) Add bromine (water) (1)

Goes from (orange / brown / red / red-brown) / to colourless / (bromine) is decolourised (1) [2]

(d)



Correct repeat unit (1)

Free bonds at the end (1) [2]

(e) Maximum / predicted mass = 1750 (tonnes)

OR

$1750 \times \frac{95}{100}$ (1)

Mass of product = 1662.5 (tonnes) (1) [2]

[Total: 10]

B9 **(a)** Melting point below 25 °C (1)
Boiling point above 25 °C (1) [2]

(b) Particles move faster / particles gain energy (1)

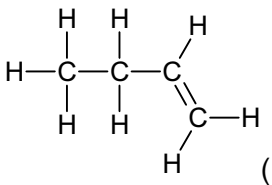
Particles spread out / move away from each other (1) [2]

(c) Volume of gas increases (1)

Particles spread out (1) [2]

(d) Ethene has a lower (relative) molecular mass / ethene has a lower formula mass / or reverse argument (1) [1]

(e) ANY TWO FROM



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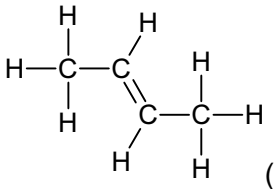

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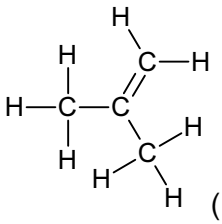
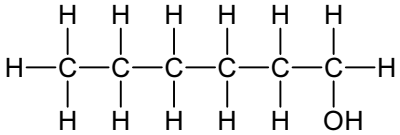


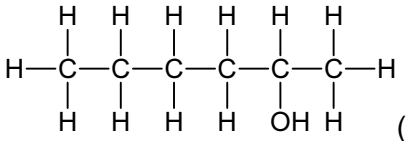
(1)

[2]

(f)



OR



(1)

[1]

[Total: 10]