

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

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.

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- A1 (a) (i)** C (1)
- (ii) A (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 H₂ or I₂ (1)
- (Forward) reaction is endothermic / reverse reaction is exothermic (1) [2]

- (d) (i)** $\text{HI} \rightarrow \text{H}^+ + \text{I}^-$ (1)
- OR**
- $\text{H}_2\text{O} + \text{HI} \rightarrow \text{H}_3\text{O}^+ + \text{I}^-$ (1) [1]
- (ii)** $\text{Ca} + 2\text{HI} \rightarrow \text{CaI}_2 + \text{H}_2$ [1]
- (iii)** $\text{CO}_3^{2-} + 2\text{H}^+ \rightarrow \text{H}_2\text{O} + \text{CO}_2$ (1)
- OR**
- $\text{CO}_3^{2-} + 2\text{H}^+ \rightarrow \text{H}_2\text{CO}_3$ (1)
- OR**
- $\text{CO}_3^{2-} + \text{H}^+ \rightarrow \text{HCO}_3^-$ (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) P₄ (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) 2PH₃ + 4O₂ → P₂O₅ + 3H₂O

Correct formulae (1)

Balancing – dependent on correct formulae (1) [2]

[Total: 12]

A4 (a) (i) B is SO₂ (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)

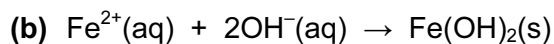
Empirical formula SO₃ (1)

Sulfur trioxide / sulfur(VI) oxide (1)

[3]

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(iii) Fe_2O_3 (1)



Equation (1)

State symbols – dependent on correct formulae (1)

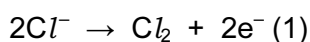
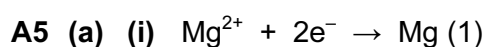
[2]

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



[2]

[Total: 9]



[2]

(b) (i) Impure copper (1)

[1]

(ii) Pure copper (1)

[1]

(c) Moles of $\text{NaCl} = 55 \times 3.5$ **OR** 192.5 (1)

Moles of $\text{Cl}_2 = 96.25/96.3$ /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]

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- (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) $3(\text{NH}_4)_2\text{CO}_3 + 2\text{H}_3\text{PO}_4 \rightarrow 2(\text{NH}_4)_3\text{PO}_4 + 3\text{CO}_2 + 3\text{H}_2\text{O}$

Correct formulae (1)

Balancing – dependent on correct formulae (1) [2]

[Total: 10]

- B7 (a)** $\text{TiCl}_4 + 2\text{Mg} \rightarrow 2\text{MgCl}_2 + \text{Ti}$ (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 $\text{TiCl}_4 = 190$ (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.
 $\text{C}_{17}\text{H}_{36} \rightarrow \text{C}_3\text{H}_6 + \text{C}_{14}\text{H}_{30}$ (1) [1]

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

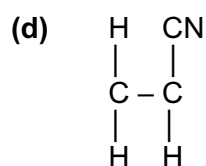
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more particles have energy above the activation energy / more effective collisions / more fruitful collisions / more energetic collisions / more (chance of) successful collisions (1)

(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]



Correct repeat unit (1)

Free bonds at the end (1) [2]

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

OR

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

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]

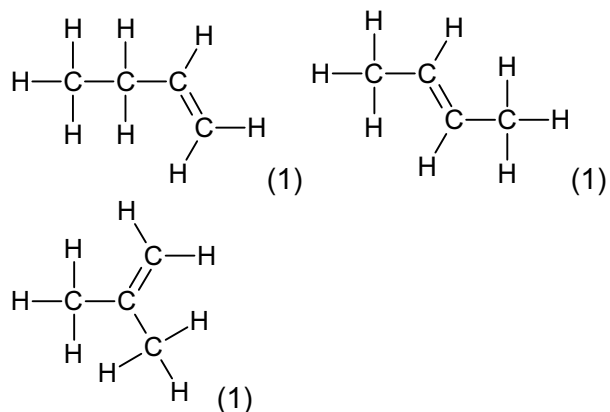
(b) Particles move faster / particles gain energy (1)
Particles spread out / move away from each other (1) [2]

(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]

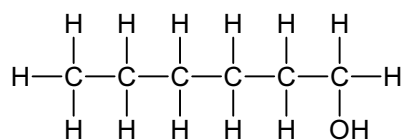
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(e) ANY TWO FROM

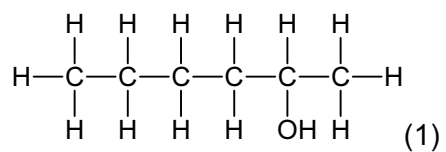


[2]

(f)



OR



[1]

[Total: 10]