

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

**MARK SCHEME for the October/November 2011 question paper
for the guidance of teachers**

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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Page 2	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE O LEVEL – October/November 2011	5070	22

- A1 (a)** zinc [1]
ALLOW: vanadium
- (b)** nickel [1]
- (c)** chlorine [1]
- (d)** chlorine [1]
- (e)** hydrogen [1]
- (f)** zinc [1]

[Total: 6]

- A2 (a) (i)** 20% [1]
- (ii)** lower temperature of (purified) air so below boiling points of gases/liquefy air/air compressed and expanded so cools to liquid; [1]
idea of distillation/temperature raised gradually oxygen remains liquid whilst nitrogen (or other gases) distil off; [1]
ACCEPT: ideas about separation according to boiling points
ACCEPT: ideas about heavier molecules having higher boiling points
- (b)** welding/joining metals; [1]
- (c)** correct dot and cross diagram for acetylene; [1]
- (d)** charges correct either on diagram or written as Mg^{2+} and O^{2-} [1]
correct electronic structures for both (2,8); [1]
- (e) (i)** $3O_2 \rightarrow 2O_3$; [1]
(ignore + uv)
- (ii)** absorbs ultraviolet radiation which is harmful/absorbs uv which causes skin cancer; [1]
ALLOW: blocks uv which is harmful

[Total: 9]

Page 3	Mark Scheme: Teachers' version	Syllabus	Paper
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- A3 (a)** substance containing only carbon and hydrogen; [1]
- (b)** C₇H₁₆ [1]
- (c)** isomers; [1]
- (d)** 45 cm³ [1]
25 cm³ [1]
- (e)** carbon monoxide formed; [1]
which is poisonous/toxic/kills you; [1]

[Total: 7]

- A4 (a) (i)** reactants on left and products on right and reactants above products; [1]
enthalpy change shown correctly; [1]
activation energy shown correctly; [1]
- (ii)** limewater; [1]
turns milky/cloudy/white precipitate; [1]
- (b) (i)** any 3 of: [3]
sulfur burns to form sulfur dioxide/correct equation;
sulfur dioxide dissolves in rainwater/correct equation;
further oxidation to sulfur trioxide in the atmosphere/correct equation; sulfur dioxide/
trioxide is an acidic oxide;
- (ii)** breathing difficulties/lung or throat irritant; [1]
- (c) (i)** lightning/high voltage/electric spark; [1]
- (ii)** 2HNO₃ + CaCO₃ → Ca(NO₃)₂ + CO₂ + H₂O [2]
1 mark for correct formulae
1 mark for balance

[Total: 12]

Page 4	Mark Scheme: Teachers' version	Syllabus	Paper
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A5 (a) atoms of same element/with same number of protons but different numbers of neutrons/
atoms with the same proton (atomic) number but different nucleon number; [1]

(b) electrons = 35 and protons = 35; [1]
neutrons = 46; [1]

(c) (i) molecules very close together; [1]
molecules random/irregularly arranged; [1]

(ii) any 3 of: [3]
faster moving/more energetic molecules escape from liquid/
diffusion/
random movement of molecules/
molecules get mixed up with molecules in the air/
molecules of bromine collide with molecules in the air

(d) (i) $\text{Br}_2 + \text{F}_2 \rightarrow 2\text{BrF}$ [1]

(ii) correct molar masses for Br and BrF_5 (80 and 175); [1]
 $100 \times 80/175 = 45.7/46\%$ [1]

[Total: 11]

B6 (a) (i) $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ [1]

(ii) iron catalyst; [1]
temperature 450°C (allow between 420 and 450); [1]
pressure of 200 atmospheres (allow between 150 and 500 atmospheres) [1]

(b) to increase crop yield/make plants grow better/replace N (or K or P) lost from soil; [1]

(c) calcium hydroxide reacts with ammonium salts to form ammonia; [1]
ammonia is a gas/gas escapes from the soil; [1]

(d) (i) fertilisers dissolve in the (ground)water; [1]
idea of leaching/movement of dissolved salts through soil to lakes; [1]

(ii) eutrophication; [1]

[Total: 10]

Page 5	Mark Scheme: Teachers' version	Syllabus	Paper
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- B7 (a)** strong acid is completely ionised in water/solution and weak acid is only partially ionised/
strong acid is completely dissociated weak acid is partly dissociated/no (or few) molecules in
strong acid but weak acid is largely molecules; [1]
- (b)** strong acid has better conductivity BECAUSE strong acid has greater concentration of
hydrogen ions/weak acid has lower conductivity
BECAUSE has lower concentration of hydrogen ions [1]
- (c) (i)** hydrogen ions are positive so move to negative electrode/hydrogen ions gain
electrons at cathode; [1]
- (ii)** $4\text{OH}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^-$ [2]
1 mark for correct reactants and products (including electron)
1 mark for balance
- (d) (i)** gas syringe attached to flask/flask with cotton wool in mouth on top pan balance; [1]
measure volume of gas/mass of flask and contents over time; [1]
rate = change in volume of gas/time or change in mass/ time; [1]
- (ii)** $3\text{g Mg} = 3/24 = 0.125 \text{ mol}$; [1]
 $\text{volume} = 1000 \times 0.125/2.5 = 50 \text{ cm}^3/0.05 \text{ dm}^3$ (unit needed) [1]

[Total: 10]

- B8 (a) (i)** ALLOW: 175–191 (actual = 187°C) [1]
- (ii)** correct structure of butanoic acid showing all atoms and bonds; [1]
- (iii)** $2\text{CH}_3\text{CO}_2\text{H} + 2\text{Na} \rightarrow 2\text{CH}_3\text{CO}_2\text{Na} + \text{H}_2$ [1]
- (b) (i)** ethyl ethanoate [1]
- (ii)** correct structure of ethenyl ethanoate i.e. $\text{CH}_2=\text{CHO}_2\text{CCH}_3$ [1]
- (c) (i)** divide by atomic masses: C = 55.8/12 H = 7/1 O = 37.2/16
C = 4.65 H = 7 O = 2.325 [1]
divide by smallest number: C = 4.65/2.325 = 2
H = 7/2.325 = 3
O = 1
Correct formula $\text{C}_2\text{H}_3\text{O}$ [1]
- (ii)** $\text{C}_4\text{H}_6\text{O}_2$ [1]
ALLOW: ecf from part (i) if 1 or 2 carbon atoms but H and/or O incorrect.
- (iii)** aqueous bromine/(acidified) potassium(VII) manganate; [1]
goes colourless [1]

[Total: 10]

Page 6	Mark Scheme: Teachers' version	Syllabus	Paper
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B9 (a) (i) $\text{Ba(s)} + 2\text{H}_2\text{O(l)} \rightarrow \text{Ba(OH)}_2\text{(aq)} + \text{H}_2\text{(g)}$ [3]
1 mark for formulae
1 mark for balance
1 mark for state symbols

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

(b) valence electrons in metallic structure are free to move [1]

(c) aluminium removes oxygen from barium oxide/oxidation number of decreases/oxidation number of aluminium increases [1]

(d) add named soluble sulfate/sulfuric acid; [1]
filter off ppt [1]
wash ppt with water; [1]
dry ppt in oven/leave ppt to dry/dry ppt in dessicator [1]

[Total: 10]