

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education O Level

MARK SCHEME for the November 2004 question paper

5070 CHEMISTRY

5070/02

Paper 2 (Theory 1), maximum mark 75

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

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NOVEMBER 2004

GCE O Level

MARK SCHEME

MAXIMUM MARK: 75

SYLLABUS/COMPONENT: 5070/02

**CHEMISTRY
Paper 2 (Theory 1)**



Page 1	Mark Scheme	Syllabus	Paper
	O LEVEL – NOVEMBER 2004	5070	2

A1	(a)		rises then falls <u>only</u> ; NOT references to B and C	1
	(b)	(i)	less than 12/any number <12;	1
		(ii)	eutrophication; weed/algae grows more/faster; <u>rotting/decomposition/bacteria</u> uses up oxygen; 'use up oxygen' alone does not score	any 2
	(c)		decreases; decreases; increases;	3
			7 marks	
A2			a to d accept correct formulae, use list principle	
	(a)		bromine and methane/(both needed)	1
	(b)		lithium	1
	(c)		iodine and bromine/Br ₂ and I ₂ (both needed)	1
	(d)		lithium and lead (II) bromide (both needed)	1
	(e)		methane has a <u>simple</u> (covalent) structure (not discussion of breaking bonds in methane); silicon dioxide has a <u>giant/lattice/macromolecular</u> (covalent) structure;	2
	(f)		electrolysis; of <u>molten</u> lead bromide; allow: (metal) displacement; by more reactive metal/named more reactive metal (magnesium, zinc, iron);	2
			8 marks	

Page 2	Mark Scheme	Syllabus	Paper
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A3	(a)	(i)	(conc) H ₂ SO ₄ ; not dilute H ₂ SO ₄ , accept phosphoric acid heat/reflux/50 - 150 °C; ignore pressure	2
		(ii)	$ \begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{OH} \\ \\ \text{H} \end{array} $ (allow condensed OH as shown)	1
		(iii)	CH ₃ COOH + C ₃ H ₇ OH → CH ₃ COOC ₃ H ₇ + H ₂ O; e.c.f. from (ii) allow molecular formulae LHS = 1 RHS = 1	2
	(b)	(i)	pH meter/universal indicator/electrical conductivity test; shows different pH/orange for carboxylic acid, red for hydrochloric/different colours (if colours stated, must be correct)/electrical conductivity different/electrical conductivity higher in HCl 1 mark max for chemical reactions: add reactive/named solid (as in (iii)) and compare rates/test for chloride ion using silver nitrate;	2
		(ii)	metal carbonate/metal oxide/named metal carbonate or named oxide (not Group I oxide or CaO)/magnesium metal, zinc metal	1
			consequential on <u>correct</u> substance- carbonate or metal – see bubbles metal oxide – solid disappears, accept dissolves	1
			9 marks	
A4	(a)		blocks oxygen uptake in blood; not 'breathing difficulties'	1
	(b)	(i)	H ₂ O;	1

Page 3	Mark Scheme	Syllabus	Paper
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		(ii)	Pd oxidation states (+)2 to 0; C oxidation states (+)2 to (+)4;	2
		(iii)	palladium has been reduced and C has been oxidised; palladium ox state has fallen, C has increased/palladium accepted electrons from carbon; e.c.f. from (ii)	2
	(c)		extraction of iron, zinc, lead or tin/blast furnace	1
			7 marks	
A5	(a)		$\text{Zn} + \text{Cu}^{2+} \rightarrow \text{Cu} + \text{Zn}^{2+}$ check equation is <u>correct direction</u> ignore state symbols	1
	(b)		arrow in external circuit from zinc to copper (to the left)	1
	(c)		zinc iron lead copper Zn and Cu correct = 1 iron lead correct = 1	2
	(d)		magnesium/aluminium	1
			5 marks	
A6	(a)	(i)	(aqueous) lithium hydroxide/lithium carbonate; not lithium oxide evaporation/(allow to) crystallise;	2

Page 4	Mark Scheme	Syllabus	Paper
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		(ii)	(aqueous) barium chloride/barium nitrate/barium hydroxide; filtration	2
		(iii)	copper oxide or copper carbonate; accept copper hydroxide <u>partial</u> evaporation (owtte)/leave to crystallise	2
	(b)		relative molecular mass $(\text{NH}_4)_2\text{SO}_4 = 132$; 34 g NH_3 makes 132 g $(\text{NH}_4)_2\text{SO}_4$ owtte; mass formed = $132/34 \times 51 = 198$ g usual calculation rules apply.	3
				9 marks
				Total Section A = 45

Section B

B7	(a)	Diagram standard rate curve shape; labels on axes 'volume' against 'time' (owtte); Explanation reaction stops when magnesium carbonate <u>used up</u>;	2 1
	(b)	$M_r \text{ MgCO}_3 = 84$; no mols $\text{CO}_2 = 10.5/84 (=0.125 \text{ mols})$; volume = $0.125 \times 24 = 3 \text{ dm}^3$ usual calculation rules apply	3
	(c)	(i) faster; because zinc carbonate is less (thermally) stable than magnesium carbonate ORA ignore references to metal reactivity	2

Page 5	Mark Scheme	Syllabus	Paper
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		(ii)	less carbon dioxide; because there are <u>fewer moles</u> of zinc carbonate. Calculation leading to $2.02 \text{ dm}^3 = 2$ marks <u>different</u> amount of CO_2 because 10.5 g zinc carbonate contains a <u>different</u> number of moles = 1 mark	2
			10 marks	
B8	(a)		A diesel oil B paraffin C naphtha	1
	(b)		fractions vaporise/evaporate/boil; <u>condense</u> at <u>different temperatures</u> ; lowest boiling points come out at highest point of tower/ temp of tower higher at bottom	3
	(c)	(i)	correct <u>method</u> Mass of C/mass of compound x 100; correct <u>masses</u> used octane $96/114 \times 100 = 84.2 \%$; <u>both fully correct</u> hexadecane $192/226 \times 100 = 85.0 \%$ Guidance: one calculation fully correct scores 2; both calculations fully correct scores 3; allow e.c.f. for minor arithmetical errors.	3
		(ii)	$2\text{C}_{16}\text{H}_{34} + 49\text{O}_2 \rightarrow 32\text{CO}_2 + 34\text{H}_2\text{O}$ ignore state symbols	1
		(iii)	less oxygen is needed (per molecule) to combust octane ORA/more carbon <u>atoms</u> in hexadecane/more <u>carbon per molecule</u> /higher percentage C by mass; 'more carbon' alone is not enough	1
	(d)		hydrogen and ethanol/alcohol ignore solar	1
			10 marks	

Page 6	Mark Scheme	Syllabus	Paper
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B9	(a)		reaction is exothermic/gives out heat/gives out energy	1
	(b)		$4\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$ (1) for Fe_2O_3 ; CONSEQUENTIAL (1) for rest of equation correct	2
	(c)	(i)	rises slowly then faster; melting the scrap is endothermic/uses energy /temperature of molten iron changes less when scrap is melting.	2
		(ii)	saving metal ores/saving energy for extraction/saves need to dispose of scrap iron.	1
	(d)	(i) and(ii)	(mark together) more carbon in high carbon steel; both alloys contain more iron than carbon;	2
		(iii)	Property: low C steel softer/weaker/more easily shaped/less brittle than high carbon steel; ORA Structure: properties change because carbon atoms are smaller than iron atoms (may come from reference to diagram)/metallic bonding is disrupted/lattice is disrupted/alloy structure is less regular/layers need to slip when steel changes shape	2
			10 marks	
B10	(a)		correct set-up showing battery and two electrodes dipping in an electrolyte; nickel at cathode and silver at anode; named electrolyte: silver nitrate.	3
	(b)		<u>anode</u> reaction: $\text{Ag(s)} \rightarrow \text{Ag}^+(\text{aq}) + \text{e}^-$; <u>cathode</u> reaction: $\text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag(s)}$; incorrect state symbols on fully correct equations (1) mark electrodes reversed with fully correct equations (1) mark	2

Page 7	Mark Scheme	Syllabus	Paper
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	(c)	(i)	Salt A: Gp1 sulphate or Gp 1/2 nitrate or zinc sulphate or nitrate or magnesium sulphate/<u>dilute</u> (aqueous) sodium chloride; Salt B: Gp 1/2 chloride or zinc chloride;	2
		(ii)	oxygen relights glowing spill; hydrogen pops when lit; chlorine bleaches (damp) litmus/indicator paper OR mix with Group I iodide/bromide, solution goes yellow/brown;	3
			10 marks	
			Total Section B = 30	