

**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**

General Certificate of Education O Level

**MARK SCHEME for the November 2004 question paper**

<b>5070 CHEMISTRY</b>	
<b>5070/02</b>	<b>Paper 2 (Theory 1), maximum mark 75</b>

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.

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**NOVEMBER 2004**

GCE O Level

**MARK SCHEME**

**MAXIMUM MARK: 75**

**SYLLABUS/COMPONENT: 5070/02**

**CHEMISTRY  
Paper 2 (Theory 1)**

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A1	(a)		rises then falls <u>only</u> ; <b>NOT</b> 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			<b>a to d accept correct formulae, use list principle</b>	
	(a)		bromine and methane/(both needed)	1
	(b)		lithium	1
	(c)		iodine and bromine/Br <sub>2</sub> and I <sub>2</sub> (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;  <b>allow:</b> (metal) displacement; by more reactive metal/named more reactive metal (magnesium, zinc, iron);	2
				8 marks

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A3	(a)	(i)	(conc) H <sub>2</sub> SO <sub>4</sub> ; <b>not</b> dilute H <sub>2</sub> SO <sub>4</sub> , <b>accept</b> 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}  $ <b>(allow</b> condensed OH as shown)	1
		(iii)	CH <sub>3</sub> COOH + C <sub>3</sub> H <sub>7</sub> OH → CH <sub>3</sub> COOC <sub>3</sub> H <sub>7</sub> + H <sub>2</sub> O; <b>e.c.f.</b> from (ii) <b>allow</b> 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  <b>1 mark max</b> 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 ( <b>not</b> 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, <b>accept</b> dissolves	1
			<b>9 marks</b>	
A4	(a)		blocks oxygen uptake in blood;  <b>not</b> 'breathing difficulties'	1
	(b)	(i)	H <sub>2</sub> O;	1

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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
			<b>7 marks</b>	
<b>A5</b>	(a)		$Zn + Cu^{2+} \rightarrow Cu + Zn^{2+}$ 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
			<b>5 marks</b>	
<b>A6</b>	(a)	(i)	(aqueous) lithium hydroxide/lithium carbonate; <b>not</b> lithium oxide evaporation/(allow to) crystallise;	2

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	(ii)	(aqueous) barium chloride/barium nitrate/barium hydroxide; filtration	2
	(iii)	copper oxide or copper carbonate; <b>accept</b> 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 $\text{NH}_3$ makes 132 g $(\text{NH}_4)_2\text{SO}_4$ owtte; mass formed = $132/34 \times 51 = 198$ g usual calculation rules apply.	3
			<b>9 marks</b>
			<b>Total Section A = 45</b>

### Section B

B7	(a)	<b>Diagram</b>	2
		standard rate curve shape; labels on axes 'volume' against 'time' (owtte);	
		<b>Explanation</b>	1
		reaction stops when magnesium carbonate <u>used up</u> ;	
	(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

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		(ii)	less carbon dioxide; because there are <u>fewer moles</u> of zinc carbonate. <b>Calculation</b> leading to $2.02 \text{ dm}^3 = 2$ marks <u>different</u> amount of $\text{CO}_2$ because 10.5 g zinc carbonate contains a <u>different</u> number of moles = 1 mark	2
				<b>10 marks</b>
<b>B8</b>	(a)		<b>A</b> diesel oil <b>B</b> paraffin <b>C</b> 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
				<b>10 marks</b>

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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 $\text{Fe}_2\text{O}_3$ ; 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)	<b>Property:</b> low C steel softer/weaker/more easily shaped/less brittle than high carbon steel; ORA  <b>Structure:</b> 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
				<b>10 marks</b>
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: $\text{Ag}(\text{s}) \rightarrow \text{Ag}^+(\text{aq}) + \text{e}^-$ ; <u>cathode</u> reaction: $\text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag}(\text{s})$ ;  <b>incorrect state symbols</b> on fully correct equations (1) mark  <b>electrodes reversed</b> with fully correct equations (1) mark	2



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