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**

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UNIVERSITY of CAMBRIDGE
International Examinations

NOVEMBER 2004

GCE O Level

MARK SCHEME

MAXIMUM MARK: 75

SYLLABUS/COMPONENT: 5070/02

CHEMISTRY
Paper 2 (Theory 1)

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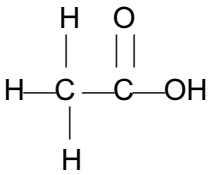
A1	**(a)**		rises then falls only; **NOT** references to B and C	**1**
	(b)	**(i)**	less than 12/any number <12;	**1**
		(ii)	eutrophication; weed/algae grows more/faster; rotting/decomposition/bacteria uses up oxygen; 'use up oxygen' alone does not score	**any 2**
	(c)		decreases; decreases; increases;	**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 simple (covalent) structure (not discussion of breaking bonds in methane); silicon dioxide has a giant/lattice/macromolecular (covalent) structure;	**2**
	(f)		electrolysis; of molten lead bromide; **allow:** (metal) displacement; by more reactive metal/named more reactive metal (magnesium, zinc, iron);	**2**
				8 marks

A3	**(a)**	**(i)**	(conc) H_2SO_4; **not** dilute H_2SO_4, **accept** phosphoric acid heat/reflux/50 - 150 °C; ignore pressure	**2**
		(ii)	 (**allow** condensed OH as shown)	**1**
		(iii)	$CH_3COOH + C_3H_7OH \rightarrow CH_3COOC_3H_7 + H_2O$; **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 HC*l* **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_2O;	**1**

		(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)**		$Zn + Cu^{2+} \rightarrow Cu + Zn^{2+}$ check equation is correct direction 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**

		(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 $(NH_4)_2SO_4$ = 132; 34 g NH_3 makes 132 g $(NH_4)_2SO_4$ owtte; mass formed = 132/34 x 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 $MgCO_3$ = 84; no mols CO_2 = 10.5/84 (=0.125 mols); volume = 0.125 x 24 = 3 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**

		(ii)	less carbon dioxide; because there are <u>fewer moles</u> of zinc carbonate. **Calculation** leading to 2.02 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 x 100 = 84.2 %; <u>both fully correct</u> hexadecane 192/226 x 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)	$2C_{16}H_{34} + 49O_2 \rightarrow 32CO_2 + 34H_2O$ 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

B9	**(a)**		reaction is exothermic/gives out heat/gives out energy	**1**
	(b)		$4Fe + 3O_2 \rightarrow 2Fe_2O_3$ (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)		anode reaction: $Ag(s) \rightarrow Ag^+(aq) + e^-$; cathode reaction: $Ag^+(aq) + e^- \rightarrow Ag(s)$; **incorrect state symbols** on fully correct equations (1) mark **electrodes reversed** with fully correct equations (1) mark	**2**

	(c)	(i)	**Salt A:** Gp1 sulphate or Gp 1/2 nitrate or zinc sulphate or nitrate or magnesium sulphate/dilute (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