OCR
RECOGNISING ACHIEVEMENT

GCE

Chemistry (Salters)

Advanced GCE **A2 7887**

Advanced Subsidiary GCE **AS 3887**

Mark Schemes for the Units

January 2007

3887/7887/MS/R/07J

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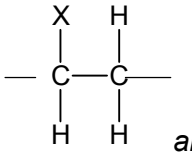
Advanced GCE Chemistry (Salters) (7887)

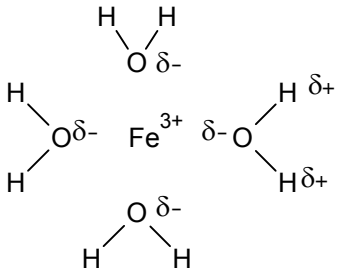
Advanced Subsidiary GCE Chemistry (Salters) (3887)

MARK SCHEME ON THE UNITS

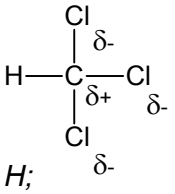
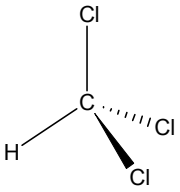
Mark Scheme 2848
January 2007

Question			Expected Answers	Marks
1	(a)		Alkene *accept triene*	1
	(b)	(i)	Red/brown/orange (1); colourless (*NOT clear*) (1)	2
		(ii)	Electrophilic (1); Addition (1)	2
		(iii)	$C_{10}H_{16} + 3Br_2 \rightarrow C_{10}H_{16}Br_6$ Formula of product (1) Balancing (1) *give this mark if correct for an addition reaction with Br_2*	2
	(c)	(i)	Water (1) *allow H_2O*	1
		(ii)	Tertiary (1); C to which OH is bonded is itself bonded to 3 other C's/no H on C to which OH is bonded/ 3 alkyl groups on C. (1)	2
		(iii)	There would be no reaction (1); Tertiary alcohols (*or defined as above*) (can't be oxidised by potassium dichromate (VI) solution). (1) *ecf from (ii) if secondary (primary): oxidised (1); to ketone(aldehyde)/orange to green (1)*	2
	(d)	(i)	Elimination (1) *ALLOW dehydration*	1
		(ii)	Conc (1); Sulphuric acid/H_2SO_4/ phosphoric acid/ H_3PO_4 (1); Heat/reflux/high temp (1) *mark separately if "acid" mentioned. Ignore pressure* or Pass vapour (1); over alumina/pumice(AW) (1); at 300ºC / heated alumina (1)	3
	(e)		 *allow brackets (and "n") Allow C_8H_{13} for X. NOT several repeats*	1

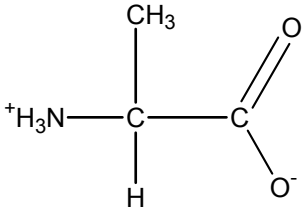
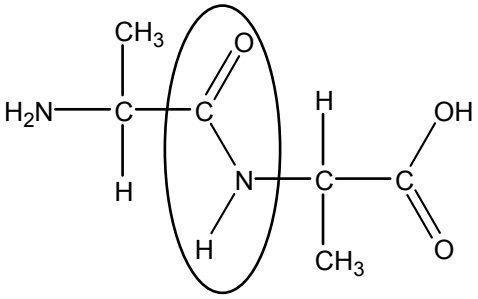
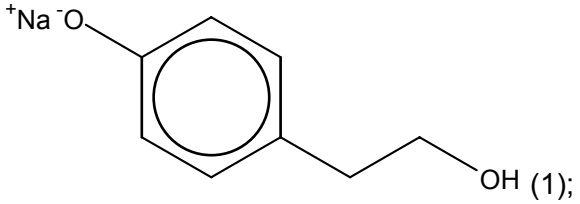
	(f)		5 from: **A** Electron movements (1) *stated or implied* **B** in the molecules create an uneven distribution of charge, leading to a temporary/instantaneous dipole (1); **C** The temporary/instantaneous dipole in one molecule creates/induces a dipole in a neighbouring molecule, then attracts it (1); **D** Compound C has stronger* instantaneous dipole – induced dipole forces than myrcene because compound C is linear/straight chained/ unbranched *ora* (1); **E** This allows greater surface contact/molecules closer together and stronger* intermolecular forces between compound C molecules *ora* (1); **F** Stronger* intermolecular forces mean that more energy is needed to overcome them/ harder to break, therefore higher b.p. *ora* (1); **allow "more" or "greater". Allow "intermolecular bonds"* QWC: Logical, correct use in context of at least three terms below: dipole*; electron; intermolecular; charge; induces*; molecule, branches ** but not in "instantaneous dipole- induced dipole"*	**5** **1**
			Total mark:	**23**
2	**(a)**	**(i)**	Increasing pressure moves equilibrium (position) (for equation 2.1) to the right/products (1); This increases (the concentration of) dissolved carbon dioxide (1).	**2**
		(ii)	Both forward and backward reactions are progressing (AW) (1); The concentration of each chemical remains constant/stays the same (1). *or* Rate of forward reaction = rate of backward reaction (2);	**2**
		(iii)	The reaction produces H^+ ions/protons, (which makes the solution more acidic) (1).	**1**
		(iv)	HCO_3^- / H_2O (1)	**1**
	(b)	**(i)**	$Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$ (1); *ignore correct spectator ions* (1) for state symbols *mark for aqueous gives solid (mark separately)*	**2**
		(ii)	Funnel with filter paper labelled (1); connected without leaks (ie showing bung) to side-arm flask with vacuum connection labelled (*allow "air out"/"pump" labelled*) (1)	**2**
		(iii)	SO_4^{2-} = (32 + 4 x 16 =) 96 (1); 0.000074 x 96 = 7.1(04) x 10^{-3} g dm^{-3} (1) *ecf from stated or implied* M_r 7.1 x 10^{-3} for s.f. mark (1) *mark separately if some working shown*	**3**

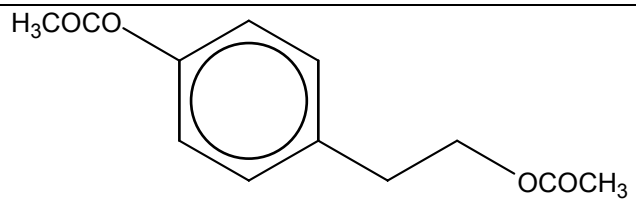
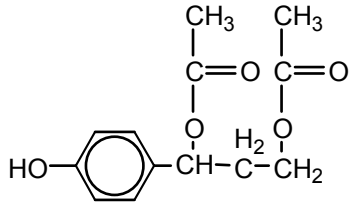
	(c)	(i)		at least three bent water molecules around an Fe^{3+} *(can be or triangle)* (1) ; 2xH and 1xO with the O facing the ion (1); δ+ on at least one H, δ – on at least one O (1) *or* $\delta-$ on point of triangle $\delta+$ at other end	**3**
		(ii)	$3d^6 4s^2$ (2) in either order 8 electrons (1)	**2**
				Total mark: **18**
3	**(a)**	**(i)**	Nitrogen (1); Oxygen (1)	**2**
		(ii)	Nitrogen(I) oxide/ nitrous oxide (1); decomposition of fertilisers (1); Nitrogen(II) oxide/ nitrogen (mon)oxide(s) (1); burning fuel/ exhaust fumes from vehicles/ combination of nitrogen and oxygen in an engine (AW)(1); Nitrogen(IV) oxide/ nitrogen dioxide (1); burning fuel/ exhaust fumes from vehicles (AW) Sulphur dioxide/trioxide/oxide(s) (1); roasting metal ores/smelting ores/burning fossil fuels/exhaust fumes from cars (1). Hydrogen sulphide (1); decomposition in landfill/ flatulence/ exhaust from cars with catalytic converter (1) *Formulae can be given instead of names (including NO_x and SO_x)* *Human activity must be a reaction or the result of a reaction and must match named compound. Two **different** human activities are required.*	**4**
	(b)	**(i)**	(Particle) with an unpaired/lone electron (1)	**1**
		(ii)	$CH_3Cl \rightarrow CH_3 + Cl$ Formula of chloromethane (1); rest of equation (1) *ecf for breakdown of another chloroalkane*	**2**
		(iii)	Catalyst and reactants are in the <u>same</u> <u>phase/state</u> (1)	**1**
		(iv)	The minimum combined (kinetic) (1); energy on collision of particles that will lead to a reaction (AW) (1) *first mark depends on second* "breaking bonds in reactants" scores (1)	**2**
		(v)	Rate of reaction increases (1); Molecules have more energy/ move faster (1); More collisions with energy greater than the activation enthalpy/energy/ sufficient energy/ more successful collisions (1)	**3**
		(vi)	$7.69 \times 10^{-19} / 6.63 \times 10^{-34}$ (1); $= 1.16 \times 10^{15}$ Hz (1) *no ecf allow 1.2 with "2sf"*	**2**

		(vii)	uv/radiation (1); does not have enough energy/ does not have a high enough frequency (1) *REJECT for second mark answers that imply intensity of radiation*	**2**
	(c)	**(i)**	(anhydrous) sodium sulphate *or other suitable salt/*silica gel (1) *ALLOW conc.* H_2SO_4	**1**
		(ii)	The bonds need a specific frequency to make them (1); vibrate (more) (1); *second mark if bond or molecule mentioned*	**2**
		(iii)	CO_2 absorbs/traps radiation that would otherwise be released into space /radiated by the Earth (1); and turns it into kinetic energy that increases atmospheric temperature (1)	**2**
			Total mark:	**24**
4	**(a)**		Sedimentation/ flocculation (1) *allow filtration*	**1**
	(b)		$3\ O_2 \rightarrow 2\ O_3$ (1) *allow halved*	**1**
	(c)	**(i)**	0 (1); -1 (*NOT 1-*) (1)	**2**
		(ii)	Chlorine is reduced during the reaction/gains electrons/decrease in ox. state (1); and the sulphur/H_2S is oxidised/ loses electrons/increases in ox. state (1)	**2**
	(d)	**(i)**	$I_2 + 2\ Cl^-$ (1) *ignore ss* Chlorine is more reactive/ stronger oxidising agent / has higher electron affinity than iodine *ora for iodine*(1)	**2**
		(ii)	$Cl_2 + 2\ e^- \rightarrow 2\ Cl^-$ *or halved* Correct species (1); balancing (1) *allow for "chlorine plus electron" equation*	**2**
		(iii)	14.0 x 0.00100 (1)/ 1000 = 1.4 x 10^{-5} mol (1) *no ecf*	**2**
		(iv)	Burette *allow one error from: wrong "r"s; wrong "t"s; no terminal "e"*	**1**
		(v)	Answer to 4(d) (iii) ÷ 2 (0.5 moles $S_2O_3^{2-}$ = 7.0 x 10^{-6} mol) (1)	**1**
		(vi)	Answer to 4(d)(iii) ÷ 2 / answer to 4(d)(v) (=7.0 x 10^{-6} mol) (1)	**1**
	(e)		*Any ONE from*: Chlorine is poisonous/toxic/is a toxin/harmful/irritant (1); Damaging to respiratory system/irritating to eyes (1); Water has unacceptable smell/taste (1). *Not 'dangerous'*.	**1**
	(f)		*Any ONE from*: bleach/ disinfectant (1); *not cleaning* making PVC (1); *not polymers or plastics* making solvents/CFCs/insecticides/HC*l* (1) bromine extraction (1)	**1**
	(g)	**(i)**	(1,1,1 -)trichloromethane (1)	**1**

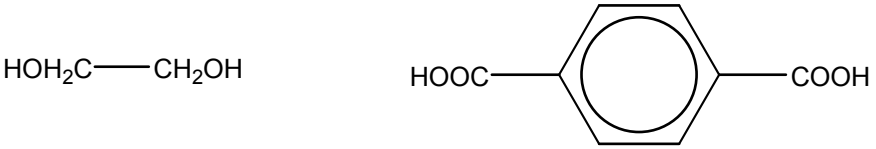
(ii)(iii)	(ii)  (1) *ignore δ+ on H;* *δ− on all chlorines*	(iii)  one line, one dotted (or reverse wedge) and one wedge plus one of these repeated (or two wedges and two dotted lines *lines must not be opposite;* *or shown as tetrahedron*	**1 + 1**
(iv)	Mention of electronegativity or explanation (1); Comparison of <u>chlorine</u> and <u>carbon</u> (1); Molecule's shape is tetrahedral (1); *allow if written on diagram above* Molecule has permanent dipole as the charges/ dipoles do not balance/ not symmetrical (1). QWC: At least 2 consecutive sentences which have correct spelling, punctuation and grammar with only one error in all (1) **see QWC sheet**		**4** **1**
		Total mark:	**25**

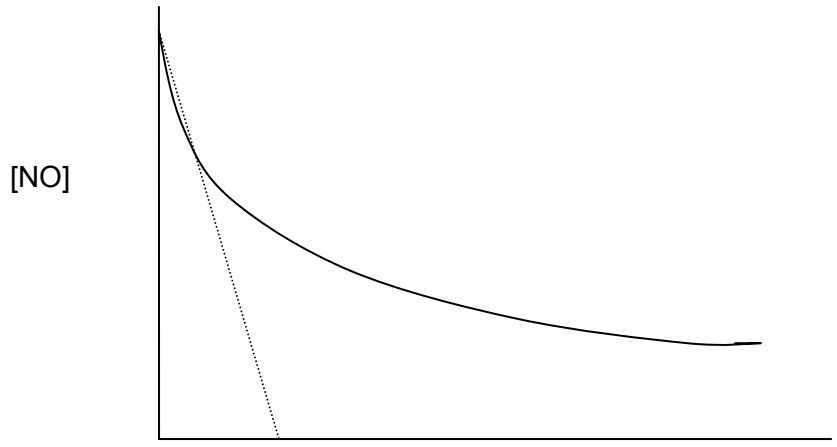
Mark Scheme 2849
January 2007

Question	Expected answers	Marks
1 (a)	Primary: order/sequence of amino acids (1); secondary: folding of amino acid chains / hydrogen bonding between chains/forms helices or sheets AW (1); tertiary: folding of protein/overall shape (1).	**3**
(b) (i)	with moderately concentrated/4-6M (HCl) acid (1); (Heat under) reflux (1).	**2**
(ii)	(Paper) chromatography (1) *allow* thin-layer.	**1**
(c) (i)	(The closer the chains) the stronger the intermolecular interactions/ the more ordered the arrangement the more/greater the number of intermolecular forces (1).	**1**
(ii)	 correct formula, *allow* COO^- (1).	**1**
(iii)	Very strong interactions/ionic/electrostatic bonds between particles (1).	**1**
(iv)	 correct formula, *allow* COOH (1); amide group (1).	**2**
(v)	Alanine has optical isomers/is chiral/ has D and L isomers/enantiomers (1); only one of the isomers will fit into enzyme and so react AW (1).	**2**
Total mark		**13**
2 (a)	***One mark each for points in bold*** *and then any* ***one*** *other up to a total of 5 marks:* Spot small sample of liquid mixture on (base) line (1); on plate/sheet (1); **solvent in beaker below sample** (1); **cover beaker with lid/film** (1); leave until solvent front nears top of plate; **locating spots with iodine/ uv radiation** (1); **2 spots seen** AW (1).	**5**
(b) (i)	 (1); H_2O (1).	**2**

	(ii)	 Formula for ethanoyl group correct (1); Both groups correct and in correct positions (1); HCl (1).	**3**
(c)	**(i)**	3600-3640 cm^{-1} O-H *or* 3200-3600 cm^{-1} O-H; 1050-1300 cm^{-1} C-O; *1 mark for the correct frequency and bond for each peak* (2).	**2**
	(ii)	Purple, *allow any shade of purple/violet but NOT pink* (1).	**1**
(d)		Equilibrium for ethanoic acid is further to the right / ethanoic acid is more dissociated/ionised ORA (1); stability of CH_3COO^- is greater ORA AW (1); electrons more delocalised in CH_3COO^- ion ORA AW (1).	**3**
(e)	**(i)**	In **C** and **D** Chem shifts at 0.5-4.5 and at 4.5-10.0/ *states* phenolic and alcoholic OHs have different chemical shifts AW (1); Ratio of 2:1 indicates **C** and 1:2 indicates **D** / **C** has a greater intensity for the alcoholic OH peak than the phenolic OH peak ORA/compare either phenolic OH groups or alcoholic OH groups/3 different OH environments in **C**, only 2 in **D** AW (1).	**2**
	(ii)	 An ester group correct (1) correct formula overall (1).	**2**
Total mark			**20**

3	**(a)**	$2FeS_2(s) + 7O_2(g) + 2H_2O(l) \longrightarrow 2Fe^{2+}(aq) + 4SO_4^{2-}(aq) + 4H^+(aq)$	**1**
	(b) **(i)**	The more positive the standard electrode potential the more powerful is the oxidising agent AW/ oxidation is the loss of electrons (1); Oxygen and water under neutral conditions have a less positive/more negative $E^\ominus$ than iron(II)/iron(III) (and would not oxidise the $Fe^{2+}(aq)$ ions) AW (1); with acid the oxygen's $E^\ominus$ is now more positive/less negative than iron(II)/iron(III) and will oxidise the $Fe^{2+}(aq)$ ions (1). *Alternative marking scheme*: $E^\ominus$ cell must be positive for a reaction to take place (1); $E^\ominus$ cell for $O_2 + H_2O$ = -(0.37 V) no reaction (1); $E^\ominus$ cell for $O_2 + H^+$ = +(0.46 V) reaction takes place (1).	**3**
	(ii)	$4Fe^{2+} + O_2 + 4H^+ \rightarrow 4Fe^{3+} + 2H_2O$ Species correct (1); balanced (1).	**2**
	(c)	Name: water/aqua *allow* H_2O (1); number: 6 (1); shape: octahedral (1).	**3**
	(d) **(i)**	iron(III) hydroxide *allow* $Fe_2O_3.xH_2O$/hydrated iron(III) hydroxide (1);	**1**
	(ii)	1. $K_c = \frac{[[Fe(H_2O)_5(OH)]^{2+}(aq)] \times [H^+(aq)]}{[[Fe(H_2O)_6]^{3+}(aq)]}$ (1); 2. The enthalpy change of the reaction / whether the reaction is exothermic or endothermic (1); 3. Iron(III) hydroxide is solid (therefore no homogeneous system)/ precipitates out (so equilibrium moves to right hand side) AW (1).	**3**
	(e)	Partly filled/incomplete d shell/energy levels/orbitals (1).	**1**
	(f) **(i)**	Ligand exchange / substitution/displacement (1).	**1**
	(ii)	Colorimetry (1).	**1**
	(g) **(i)**	(Dilute) sulphuric acid (1).	**1**
	(ii)	Moles of MnO_4^- = (16.6/1000) x 0.010 = 0.000166 (1); moles of iron(II) = 5 x (16.6/1000) x 0.010 = 0.000830 (1) *ecf*; concentration = 0.0332 mol dm^{-3} (1) *ecf*; answer must be to 3 sig. figs.	**3**
	(iii)	The first permanent (pale) pink colour (1).	**1**
Total mark			**21**
4	**(a)**	**E** condensation **F** condensation **G** condensation **H** addition all correct (2); one incorrect (1).	**2**
	(b)	Ester (1).	**1**
	(c)	Biodegradable AW (1).	**1**

(d)	Any **five** from the following **six** marking points Hydrogen-bonding is stronger than permanent dipole-permanent dipole forces which are stronger than instantaneous dipole-induced dipole forces / hydrogen bonding is the **strongest** type of intermolecular force (1); **H** only id-id forces (1); **G** + pd-pd forces (1); **E** has hydrogen bonding (1); hydrogen bonding stronger in **E** than **F** because of shape/structure of polymer chains (1); aramids/benzene rings have flat molecules/ can get very close/ more hydrogen bonds per unit length (1). QWC *see separate sheet for detailed description* (1).	**5** **1**
(e) (i)	aqueous acid / alkali NOT concentrated OR weak acid (1); (heat under) reflux (1).	**2**
(ii)	 *If alkali is used then the COOH group should be written as COO^-:* *1 mark for each stucture* (2).	**2**
(f)	At low temperatures polymers may become brittle/AW (1); temperature below polymer T_g (1); due to chains unable to move over each other (without breaking)/chain movement not possible (without breaking) (1).	**3**
Total Mark		**17**

5	**(a)**	**(i)**	Outer electron structure of cobalt is d7 s2 / full outer s level/ only 7 electrons in d level (1); cobalt's outer electrons are in the 3rd and 4th shells AW (1).	**2**
		(ii)	Any two marking points from three: they form ions in different oxidation states / available d orbitals AW (1); oxidation states can interconvert during the reaction so are unchanged at the end AW / (can use d orbitals/electrons) to bond reactants to surface (1); activation enthalpy/energy is lowered (1).	**2**
		(iii)	Liquid state/ allow soluble or in same state as methanol/reactants or aqueous (1).	**1**
	(b)	**(i)**	Colorimetry (1) because colour change in reaction colourless to brown (1); or pressure measurements (1) because a decrease in moles/amount of gas in the reaction/ allow volume change (1); or pH measurement (1) because solution of gases becomes more acidic as reaction proceeds (1); or bubble gases through limewater (1) measure rate of cloudiness occurring AW (1).	**2**
		(ii)	Graph as below (1);  describes/draws tangent at t=0 (1); measures gradient of tangent (1); gradient = rate of reaction.	**4**
	(c)	**(i)**	[NO] 2nd [CO] zero [O_2] zero; 1 mark each (3).	**3**
		(ii)	Rate = k x $[NO]^2$ Rate = k (1); $[NO]^2$ *ecf only if equation begins with Rate* = (1).	**2**

(iii)	*e.g* k = 5.0 x 10^{-4} /(2.50 x 10^{-4})^2 (1) *ecf*; = 8000 (1) *ecf if scale factor is missing* k = 0.8 ; Units: mol^{-1} dm^3 s^{-1} *allow ecf for incorrect rate equation only if equation begins with* Rate = (1).	**3**
Total		**19**

Mark Scheme 2850
January 2007

1 (a)	(i)	Either NO or NO_2; (1) allow N_2O; N_2O_5 NOT N_2O_4	**1**
	(ii)	hydrocarbon(s) (1) allow named hydrocarbon unburnt fuel and H = hydro C = carbon	**1**
	(iii)	incomplete/partial combustion (of hydrocarbons/petrol/fuel/carbon)/ fuel burns with insufficient oxygen AW	**1**
	(iv)	loss/removal of oxygen/ON goes down/goes from + to zero (1) N gains (control) of electrons	**1**
(b)	(i)	Any **three** of : longer/bigger molecules in diesel; more air/oxygen needed (AW) (for complete combustion;) lower (operating) temperatures; lower H to C ratio; Partial/incomplete combustion of fuel;	**3 max**
	(ii)	reaction of N_2 with $O_2$from air(1); at high temps in engine(1); CON: N from fuel or NO_x lower combustion temp in diesel engine/less O_2 to react with N_2(1)	**3**
(c)		Step 2(1); Steps 3,4 & 5(1); Step 6(1)	**3**
(d)	(i)	reaction A = cracking; B=isomerisation; C=reforming; D= reforming	**4**
	(ii)	skeletal (must read like skeletal eg skeletal)	**1**
	(iii)	C_9H_{20}(1); 3(4)-ethyl-4(3)-methylhexane (1) for hexane; 1 for ethyl then methyl; 1 for correct numbers) ignore commas or dashes	**4**
	(iv)	higher octane number/rating/less auto ignition NOT better or branched	1 **23**

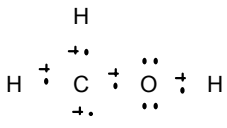
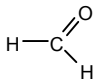
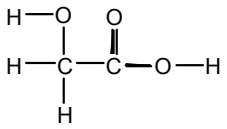
2	**(a)** **(i)**	-2 (2-)	**1**
	(ii)	reasonable attempt at a tetrahedral shape(1) NOT 90^0; correct use of wedges/dashes(allow dotted line) (1) No O atoms shown max 1	**2**
	(b) **(i)**	frequency/energy(1)	**1**
	(ii)	**emit light**:- electrons raised to higher electronic levels(1); electrons drop back to lower levels losing energy (as 'light')1 **discrete lines:-** energy levels 'quantized' (AW)/drops give out a specific amount of energy/drops between levels(1 relates to specific frequencies/(Δ)E=hu(1) **sets of lines:-** each set represent drops to a different lower level/ mention of specific example eg Lyman(1) Excited ATOMS/no mention of electrons max four marks NB these points could be gained from an annotated diagram.	**5**
	(iii)	Similarities – lines (spectrum)(1);lines in same place/same spacing/lines converge(1) Difference – black lines (on a bright background) compared to coloured lines (on a black background)(1);	**3**
	(c)	ease of thermal decomposition of carbonates; solubility of carbonates; insolubility of hydroxides/nitrates; AW/ora two max must use named clasof compound to gain marks	**2**
Total			**14**

<table>
<tr><td>3 (a)</td><td>Number of electrons(1); Number of protons(1) (allow protons <u>and</u> electrons)
protons <u>plus</u> electrons zero</td><td>2</td></tr>
<tr><td>(b) (i)</td><td>properties/reactivities of the elements fitted better (when swapped)/ fitted with fluorine,chlorine,bromine/halogens(1) CON atomic number</td><td>1</td></tr>
<tr><td>(ii)</td><td>
<table>
<tr><th>Isotope</th><th>Percentage abundance</th><th>isotopic mass x relative abundance</th></tr>
<tr><td>tellurium-120</td><td>0.09</td><td>11</td></tr>
<tr><td>tellurium-122</td><td>2.46</td><td>300</td></tr>
<tr><td>tellurium-123</td><td>0.87</td><td>107</td></tr>
<tr><td>tellurium-124</td><td>4.61</td><td>572</td></tr>
<tr><td>tellurium-125</td><td>6.99</td><td>874</td></tr>
<tr><td>tellurium-126</td><td>18.71</td><td>2357</td></tr>
<tr><td>tellurium-128</td><td>31.79</td><td>4069</td></tr>
<tr><td>tellurium-130</td><td>34.48</td><td>4482</td></tr>
</table>
one mark for correct completion of table(1); one mark (ecf) for addition and divided by 100 only (12772/100); one mark for 3 sig. figs. (128); ecf</td><td>3</td></tr>
<tr><td>(iii)</td><td>neutron(1)</td><td>1</td></tr>
<tr><td>(c) (i)</td><td>group 1/alkali(ne) metals(1)</td><td>1</td></tr>
<tr><td>(ii)</td><td>goes to a minimum then rises/goes down then up AW(1)</td><td>1</td></tr>
<tr><td>(d) (i)</td><td>$2Cu(s) + O_2(g) \rightarrow 2CuO(s)$ one mark for correctly balanced equation(1);
accept multiples/halves etc one mark for state symbols (independent)(1);</td><td>2</td></tr>
<tr><td>(ii)</td><td>1/24 mole of air(0.042)(1); 1/24 x 80/100 (0.033) mole of N_2 (1)</td><td>2</td></tr>
<tr><td>(iii)</td><td>mole of Mg = x3 d(ii) ecf (0.099)(1); mass = x 24(2.4g)(1) (x24.3 = 2.41 OK)</td><td>2</td></tr>
<tr><td>(e) (i)</td><td>$^{238}_{92}\text{U} + {}^{1}_{0}n\,(1) \rightarrow {}^{239}_{93}Np\,(1) + {}^{0}_{-1}e\,(1)$ (ecf for n and/or e)</td><td>3</td></tr>
<tr><td>(ii)</td><td>protons positively charged(1); therefore repelled by <u>nucleus</u>(1);
(protons repelled by positive nucleus – 2 marks)</td><td>2 [20]</td></tr>
</table>

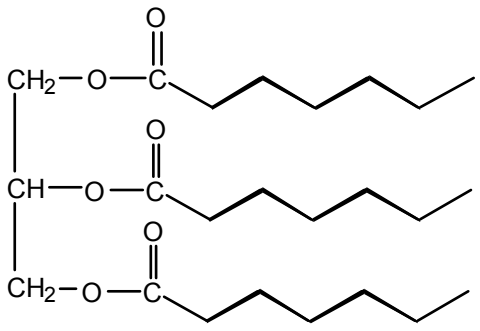
(a)	**(i)**	Enthalpy <u>change</u> when <u>1 mole</u> of compound(1); formed from elements in their standard <u>states</u> NOT conditions(1)	**3**
	(ii)	look for…..{-9736(2); -13276(1); +9736(1); 9736(1)} ecf's apply	**2**
	(iii)	aluminium and nitrogen(1); ΔH_f = zero for elements/Al and N unchanged(1); second mark can be independent	**2**
(b)		any three from CO_2/CO/C/H_2O/NO_x (3) should be names but correct formulae OK	**3**
(c)	**(i)**	correct bonding electrons shown(two different sets of three between the <u>two</u> N atoms)(1); lone pair on each of <u>two</u> N(1); maximum <u>one</u> mark if all electrons same.	**2**
	(ii)	high bond enthalpy/(very) strong (triple) bond /lots of energy needed to break it AW (1); nucleus attracted strongly to <u>bonding</u> electrons (1);	**2**
(d)		Gases formed(1); gases have higher entropy than solids(1); (if <u>above</u> discussed in terms of liquids max 1.) more particles/(moles of) products(1); <u>more</u> ways of arranging products/<u>more</u> disordered(1); NOT atoms	**4**
Total			**18**

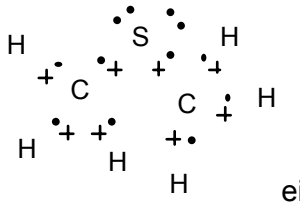
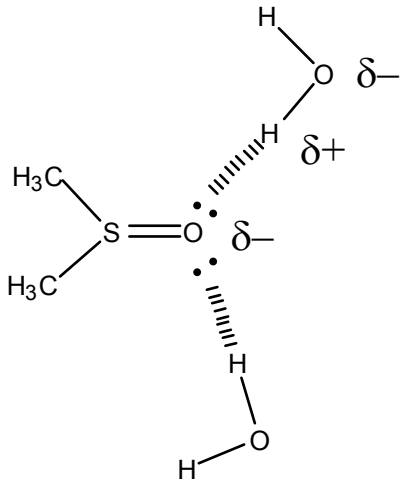
Paper total **[75]**

Mark Scheme 2854
January 2007

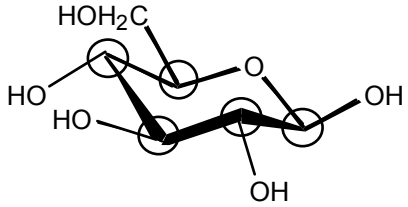
1	**(a)**	 shared pairs (1); lone pairs on oxygen (1)	**2**
	(b) **(i)**	greater yield of/more methanol (1); equilibrium (position) moves to side with fewer molecules (1) faster (1); Greater <u>frequency/probability/chance</u> (AW) of collisions (1) CON for second mark if "higher pressure makes particles move faster"	**4**
	(ii)	Exothermic (1); On raising temperature, <u>equilibrium</u> (position) moves to left/smaller yield (1) ALLOW 1 for "expense does not justify increased rate"	**2**
	(c) **(i)**	240 - 262 – 198 (1) = -220 (1). Score (1) for +220 (sign must be present)/failure to double value for hydrogen (-89)/correct answer (with sign) from incorrect expression	**2**
	(ii)	Fewer molecules on right (AW)/fewer ways of arrangement/less disorder (1) *no ecf*	**1**
	(d) **(i)**	$K_p = pCH_3OH/pCO \times p^2H_2$ (2) (1) for one error: [ ] not p (but ALLOW p with [ ]) inverted square omitted NO credit if addition occurs	**2**
	(ii)	K_p = 90/2 x 4 (*ecf from (i) unless added)* = 11/11.3/11.25 (1) atm^{-2} (1) *mark separately, ecf from (i)*	**2**
	(e)	The reactants (that go into a chemical process)/ the chemicals (AW) that go into a chemical process/reaction (1) NOT raw materials	**1**
	(f) **(i)**	$2CH_3OH + O_2 \rightarrow HCHO + 2H_2O$ species(1) balancing (1)	**2**
	(ii)		**1**
	(g) **(i)**	nucleophilic (1); addition(1)	**2**
	(ii)	 COOH (1) Rest of structure (1) *Allow OH no ambiguous attachments* (2)-hydroxyethanoic acid (1) *no ecf; IGNORE number before hydroxy*	**3**

(h)	methanol (1); O-H/alcohol at 3300 (cm^{-1}); (1) no C=O (at 1700)/C-O at 1050 (1); *two from:* two environments; four protons/ratio 3:1; CH_3–O at 3.3; O–H at 2.6 (1) QWC Use of three of the terms below in the correct context. (2) Use of two of the terms below in the correct context. (1) peak; absorbance; wavenumber/cm^{-1}; proton (NOT in "proton nmr"); environment; bond; (chemical) shift	**5** **2**
		31

2	**(a)**	N=N ringed(1)	**1**
	(b)	iron(III) (chloride) (1); goes (from yellow to) purple (AW) (1) *2nd depends on first*	**2**
	(c)	$C_{16}H_{12}ON_2$ (2) (1) for a single error	**2**
	(d)	A with D or E (1); D with A or B (1) B and C scores (1)	**2**
	(e)	D (1) phenylamine/aniline/aminobenzene (1) B (1) (1-amino-2-naphthol)	**3**
	(f) (i)	CH_3Cl/chloromethane (1) $AlCl_3$/aluminium chloride (1) anhydrous or reflux (1) *reflux mark if one other scored*	**3**
	(ii)	electrophilic ALLOW Friedel Crafts	**1**
	(iii)	chromophore	**1**
	(iv)	<u>electrons</u> promoted to higher energy levels/excited; absorb in visible/ absorb colour; E = hv/ frequency proportional to energy; complementary colour transmitted/reflected *NOT emitted (or in terms of colour absorbed) MAX 2 for absorption points if emission also described*	**4**
	(g) (i)	 three carbon backbone (skeletal or with hydrogens) (1); ester groups (correct way round) (1); side-chains (at least 6C) (1)	**3**
	(ii)	*two from:* **A** imf in oil permanent dipole-permanent dipole/ instantaneous dipole-induced dipole (1) **B** imf in water hydrogen bonds (1) **C** imf between water and dye i-d– i-d. / <u>few/no</u> hydrogen bonds(1) **D** imf between oil and dye i-d–i.d *or description of weak imf*(1) *and* **E** relative strengths of imfs/ hydrogen bonds strong (in context) (1) **F** dissolving occurs if bonds broken equals/less than bonds made (AW) (1)	**4**
			26

3	**(a)** **(i)**	 eight electrons round S(1) two lone pairs and two bonding pairs around S (1);	**2**
	(ii)	100 – 112° *ecf from (a)(i)* (1) (four) pairs of electrons/areas of negative charge/ lone pairs and bonding pairs (1); repel and get as far away from each other as possible/ explanation of departure from angle because of lone pairs (1)	**3**
	(b) **(i)**	electronegativities (of S and O) similar/ equal sharing of electrons (1)	**1**
	(ii)	symmetrical (AW) shape (1); dipoles cancel (1)	**2**
	(iii)	 two water molecules correctly hydrogen bonded (1) pair of partial charges (1) lone pairs *on at least one bond*(1); O-H-O straight *twice*(1)	**4**
	(c) **(i)**	they form S-S bonds (1); that link (protein) chains together/ maintain tertiary structure /3D shape (1) *mark separately*	**2**
	(ii)	$(CH_3)_2S + 2H_2O_2 \rightarrow (CH_3)_2SO_2 + 2H_2O$ Species correct (allow H_2 formed) (1); Balanced (*allow balanced with DMSO for second mark*) (1)	**2**
	(iii)	As MSM but with H or C_2H_5 replacing CH_3/ other structures provided bonding works	**1**
	(d)	(higher) (specific) heat capacity (1) hydrogen bonding (1) more energy needed to break/ overcome imf/ make molecules move around (AW)(1)	**3**
			20

4 (a) (i)	power stations/ car exhaust (1); burning of fuels (1) *allow "fuels containing sulphur" for alternative to first mark*	**2**
(ii)	acid rain (1); *two from:* attacks buildings damages trees/plants damages/kills fish causes respiratory problems (2)	**3**
(b) (i)	left (of Period)/ metal/ alkaline earth/ Group 2 (1)	**1**
(ii)	moles SO_2 = 15000/24 (= 625) (1); x74/1000 = 46 kg (1) 2sf *mark separately, provided some calculation is shown* (1)	**3**
(c) (i)	IV (1)	**1**
(ii)	H^+ (1) equilibrium sign (1);	**2**
(iii)	$K_a = [H^+]\,[HSO_3^-]/[H_2SO_3]$ (2) inverted or no square brackets (1)	**2**
(iv)	$[H^+] = \sqrt{K_a}\,[H_2SO_3] = \sqrt{1.5 \times 10^{-3}} = 3.87 \times 10^{-2}$ (1) pH = –log $[H^+]$ = 1.4(1) (1) *ecf from a calculated value of $[H^+]$*	**2**
(v)	$[H^+]$ = 0.2(1) pH = -log(0.2) = 0.7 (1*) no ecf* *pH = 1 (failure to double $[H^+]$),or 1.3 (from $[H^+] = 0.5$) scores* (1)	**2**
(d) (i)	maintains/little change in pH (1); when small (1); amounts of <u>acid or alkali</u> added *(allow as part of subsequent explanation)* (1); addition of acid, moves equm (position) to left, removing H^+ (ora for OH^-) (1) reservoir of [HA] and $[A^-]$/large values so H^+ concentration hardly changes (1) QWC 2 sentences only one error in SPAG	**5** **1**
(ii)	$[H^+] = K_a \times 0.001/0.002$ (= 7.5×10^{-3}) (1); pH = 2 /2.1(2) (1) *no ecf* *pH =1.52 from inverted ratio scores (1)*	**2**
		26

5	**(a)** **(i)**	OH on CH_2OH circled(1) *allow CH_2OH circled; allow on glucose*	**1**
	(ii)	 (2) for all (1) for two (or three/four with one wrong) *allow on glucosamine* zero if all carbons circled	**2**
	(iii)	ring not planar/ no double bonds/ no delocalisation/ not based on benzene. *ALLOW* oxygen atom	**1**
	(b)	$-NH_2$ (1) + HCl $\rightarrow$ $-NH_3^+$ (1); + Cl^- (1)	**3**
	(c) **(i)**	halogenoalkane/chloroalkane	**1**
	(ii)	HCl/(conc) hydrochloric acid/$SOCl_2$/PCl_5/ NaCl and H_2SO_4 (1)	**1**
	(iii)	ammonia/NH_3 (1); heat in sealed tube (AW) (1); *second depends on first*	**2**
	(iv)	nucleophilic (1); substitution (1)	**2**
	(d) **(i)**	condensation *allow co-polymerisation*	**1**
	(ii)	oxidation	**1**
	(iii)	(secondary) amide *NOT peptide*	**1**
	(iv)	ethanoic anhydride/ethanoyl chloride *NOT ethanoic acid*	**1**
			17

Advanced GCE Chemistry (Salters) (3887/7887)
January 2007 Assessment Series

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u
2848	Raw	90	69	62	55	48	41	0
	UMS	120	96	84	72	60	48	0
2849	Raw	90	65	57	49	41	34	0
	UMS	90	72	63	54	45	36	0
2850	Raw	75	52	45	39	33	27	0
	UMS	90	72	63	54	45	36	0
2854	Raw	120	85	76	67	58	50	0
	UMS	120	96	84	72	60	48	0
2855	Raw	90	76	68	60	52	44	0
	UMS	90	72	63	54	45	36	0

Specification Aggregation Results

Overall threshold marks in UMS (*i.e.* after conversion of raw marks to uniform marks)

	Maximum Mark	A	B	C	D	E	U
3887	300	240	210	180	150	120	0
7887	600	480	420	360	300	240	0

The cumulative percentage of candidates awarded each grade was as follows:

	A	B	C	D	E	U	Total Number of Candidates
3887	14.0	33.7	56.3	78.9	96.6	100.0	368
7887	21.7	55.1	79.7	94.2	97.1	100.0	71

439 Candidates aggregated this series.

For a description of how UMS marks are calculated see:
http://www.ocr.org.uk/exam_system/understand_ums.html

Statistics are correct at the time of publication.

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