OCR
RECOGNISING ACHIEVEMENT

GCE

Chemistry (Salters)

Advanced GCE **A2 7887**

Advanced Subsidiary GCE **AS 3887**

Mark Schemes for the Units

January 2008

3887/7887/MS/R/08J

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Advanced GCE Chemistry (Salters) (7887)

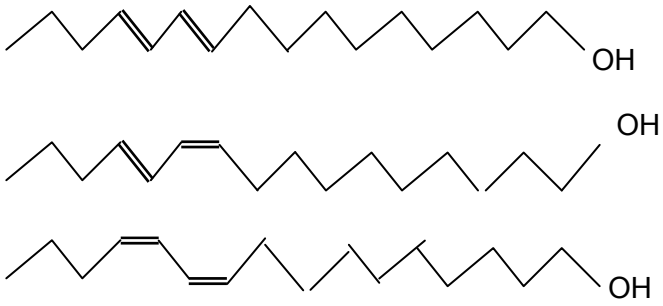
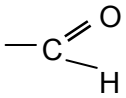
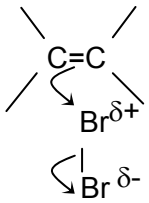
Advanced Subsidiary GCE Chemistry (Salters) (3887)

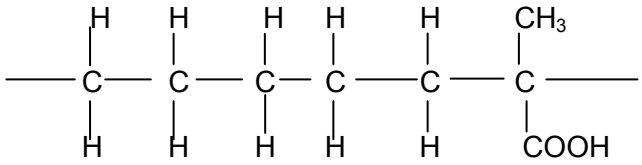
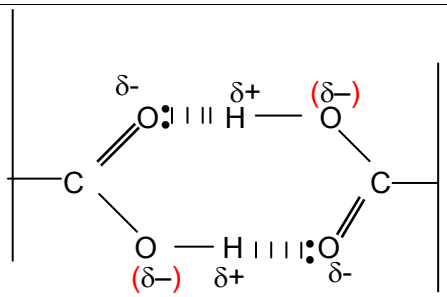
MARK SCHEME ON THE UNITS

2848 Chemistry of Natural Resources

Mark Scheme Page 1 of 5	Unit Code 2848	Session January	Year 2008	Version Final

1 (a) (i)	$CaCO_3 \rightarrow CaO + CO_2$ *ignore ss*	1
(ii)	SiO_2 giant covalent/ network solid/ lattice/ whole structure held together by covalent bonds/ correct diagram (1); *ignore "giant molecule"* CO_2 simple molecular/ molecules/ O=C=O (AW) (1); *ignore "covalent"* *Comparison of imf*: Weaker intermolecular forces in CO_2 (*can be named and can be abbreviated*)/ less energy needed to separate molecules/ bonds in SiO_2 are stronger than CO_2 imfs (1) *mention of imf for SiO_2 is CON to third mark*	3
(b)	395 x 100 / 1 000 000 = 0.0395 (%) (1)	1
(c) (i)	Increased CO_2(g) moves equilibrium (position) in equation 1.1 to the right/ more products (1); Increased CO_2(aq) moves equilibrium (position) in equation 1.2 to the right/ more products (1); *Word "equilibrium" must appear at least once here or in introductory sentence to score any of these marks.* H^+ concentration/ acidity increases (1) *Allow "more H^+"* *Just one equilibrium described – max (2).*	3
(c) (ii)	*One of:* Death/ reduced number of/ harm to sea creatures/ plants (1); Dissolving/ removal of seabed minerals (1)	1
(d)	*Four from:* • Earth emits ir* • CO_2 absorbs ir* • Which causes the bonds to vibrate (more) *allow this for other radiations absorbed;* • More CO_2 molecules means more radiation is absorbed • This is turned into kinetic energy which raises the temperature/ molecules radiate ir which warms Earth/atmosphere **allow: long-wave or low frequency radiation* QWC: Two sentences, spelling (*one error allowed*), punctuation and grammar correct (1)	4 1
(e) (i)	Burn less fossil fuels/ alternative power sources (1); Less deforestation/ plant more trees (AW)/ more photosynthesis (1)	2
(ii)	Capture and storage of the gas would need lots of equipment (AW)/ energy/ compression (AW)/ remedying environmental consequences (1)	1
		17

Mark Scheme Page 2 of 5	Unit Code 2848	Session January	Year 2008	Version Final	
2 (a) (i)	Alkene (1); Alcohol/ hydroxy(l) (1)				2
(ii)	$C_{16}H_{30}O$				1
(b) (i)	Three (1)				1
(b) (ii)	*One from:*  Correct orientation of *cis*/ *trans (for trans-cis this must be relative to OH*); *must be adjacent*(1) *allow this marking point if structures not skeletal* Completely correct (1);				2
2 (c) (i)	 				1
(ii)	(Potassium/sodium) dichromate/ correct formula (1); (Sulphuric) acid (1); *NOT nitric or carboxylic. Allow correct formulae* Heat (provided dichromate is given) (1)				3
(iii)	Oxidation (1)				1
(d) (i)	(Partially) positively charged/ electron deficient reagent/ attracted to negative charge/ electrons (AW) (1); bonds by accepting a pair of electrons (1)				2
(ii)	 Correct partial charges on both Br atoms (1); Curly arrow from double bond to Br (1); must start at double bond and end somewhere in gap Curly arrow from bond to Br (1) can score (1) for both correct arrows but half heads				3
(iii)	Carbocation (1) Accept carbonium ion				1
					17

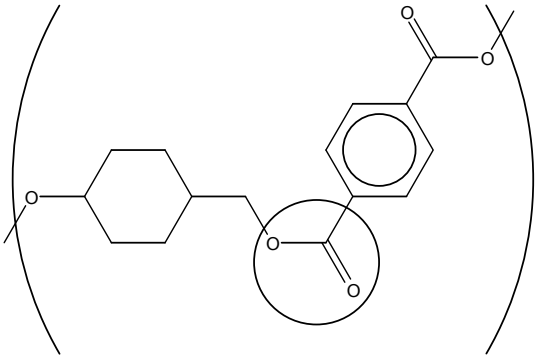
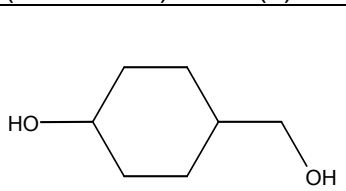
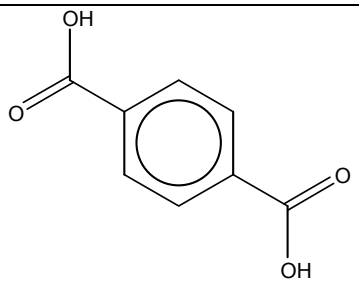
Mark Scheme Page 3 of 5	Unit Code 2848	Session January	Year 2008	Version Final	
3 (a) (i)	 (or different order) (2); *ALLOW brackets and "n".* one error (1)				2
(ii)	Copolymer (1)				1
(b)	 C=O or C–OH with corresponding hydrogen bond correctly drawn (1); Lone pair on relevant oxygen, pointed along bond (1); *mark separately** Partial charges on relevant atoms (1) *mark separately** **if bond is between a hydrogen and an oxygen*				3
(c)	Strong (hydrogen) bonds/imf (1); idea of less relative movement of chains, eg prevent chains from sliding over one another (1)				2
(d)	Sodium/ potassium hydroxide (1) Accept any soluble base *ALLOW correct formula*				1
(e)	Softens/ flows/ melts when heated/ warmed/ easily melted/ low melting *IGNORE cross linking*				1
(f) (i)	Propene (1) *ALLOW prop-1-ene*				1
(ii)	M_r of repeat unit = 70 (1); n = 28 000 / M_r (= 400) (1)				2
(iii)	Instantaneous (dipole–) induced dipole (*or reversed, NOT "temporary")*/ Van der Waals (1)				1
(iv)	Flexible/ low melting point/ stretches/ thermoplastic/ easily remoulded/ melts above room temp (NOT "solid")/ waterproof/ insulator/ insoluble in water(1) IGNORE malleable, references to boiling point *No ecf from incorrect answer to (iii)*				1
					15

Mark Scheme Page 4 of 5	Unit Code 2848	Session January	Year 2008	Version Final	
4 (a) (i)	4.1 (1); *(or equation – allow slight copying error)* sulphur/ S (1) *NOT CuS*				2
(ii)	4.2 (1); *(or equation – allow slight copying error)* (2)NH_4^+/ ammonium ion (1); It has donated a proton/ H^+ ion (1) *mark separately* *Allow Lewis acids in 4.3 as follows:* *4.3 (only scores if one answer below is correct)* *Cu^{2+} (1) electron pair acceptor (1)*				3
(b) (i)	sulphur dioxide dissolves to form an acid (1) *ALLOW acid rain* which damages trees/ lakes/ fish/ human health/ buildings (1); *mark separately*				2
(ii)	Fit 'absorbers'/ scrubbers to the chimney to remove SO_2 from waste gases/ making sulphuric acid (1)				1
(c) (i)	$Cu^{2+} + Zn \rightarrow Zn^{2+} + Cu$ *ignore ss* Correct formula for zinc ion (1); *ALLOW* $Cu^{2+} + 2e \rightarrow Cu$ for 1 mark Completely correct (1)				2
(ii)	$3d^{10}4s^1$ *or reversed* (2); $3d^94s^2$ (or reversed) scores (1)				2
(d) (i)	200 x 0.0500 /1000 = 0.01(0) (2); 200 x 0.05(00) or 200/1000 (1)				2
(ii)	Mass Cu = 0.01 x 63.5 (1) (= 0.635g) *ecf from d(i)* % Cu = *answer to first marking point* x 100 / 0.80 (= 79.375) *allow any sf* (1) 79 (1) *allow any answer to 2sf provided the number is the result of some calculation*				3
					17

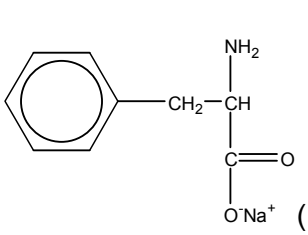
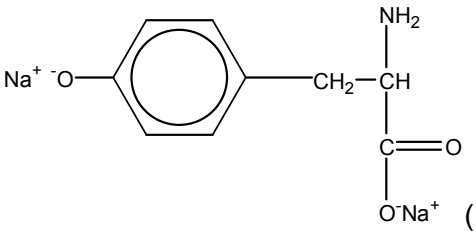
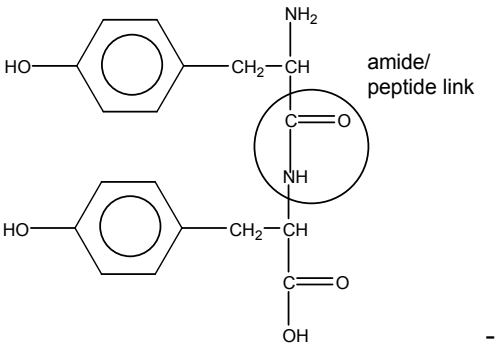
Mark Scheme Page 5 of 5	Unit Code 2848	Session January	Year 2008	Version Final	
5 (a)	Bromoalkanes/ halogenoalkanes/ haloalkanes (1)				1
(b)	crude oil/ natural gas/ (sea)water/ brine (1)				1
(c) (i)	$Cl_2 + 2Br^- \rightarrow Br_2 + 2Cl^-$ completely correct (2) all formulae correct (1) ALLOW $2Br^- \rightarrow Br_2 + 2e$ for 1 mark (or minus electrons)				2
(ii)	+4 (1) +6 (1) (1) for 4+, 6+ *or* 4, 6. Oxidised because oxidation state has increased (1) *mark separately IGNORE loss of electrons*				3
(iii)	0.07/80 (1); = 9×10^{-4} ALLOW 8.75×10^{-4} / 8.8×10^{-4} mol dm^{-3} (1) *no ecf from 1st mpt*				2
(iv)	0.81/ Answer from (c) (iii) (= 900) (1)				1
(v)	Red/brown/ red-brown (1)				1
(d) (i)	$CH_3OH + HBr$ (1) $\rightarrow CH_3Br + H_2O$ (1) *allow BrH etc*				2
(ii)	Nucleophilic (1); Substitution (1)				2
(e)	A catalyst provides (an alternative route for the reaction that has) a lower activation enthalpy (1); The activation enthalpy is the energy needed for a <u>collision</u> to result in a reaction (1); *mark separately* more effective collisions/ more collisions will occur with greater than the activation enthalpy/ more successful collisions (1) *NOT in context of more energy/greater temperature*				3
(f)	*Up to four from:* CFCs are not broken down/ unreactive in the troposphere (1); CFCs are broken down in the stratosphere (AW) (1); by high energy/ frequency uv/ radiation (1); producing chlorine atoms/ radicals (1); *or equation* that catalyse ozone breakdown (1) *or implied* *plus up to two from:* C–Br bond is weaker (than C–Cl) (1); so can be broken in the troposphere/ molecule reacts in the troposphere (1); *or* Bromomethane contains C–H bonds that are weaker (than C–Cl) (1); so can be broken in the troposphere/ molecule reacts in the troposphere (1) QWC: Two sentences, logical, at least two terms from this list, used correctly: Troposphere/ stratosphere, uv, radiation, catalyse/ catalyst/ catalytic, homolytic fission, photodissociation, radical. *Place dots over words*				5 1
					24

2849 Chemistry of Materials

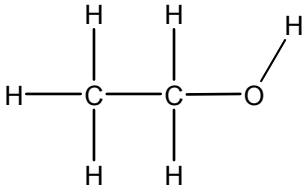
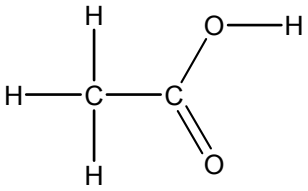
Mark Scheme Pages 1 of 5	Unit Code 2849	Session Jan	Year 2008	FINAL

Question	Expected answers	Marks
1 (a)	Will not hydrolyse when in contact with aqueous solutions AW/ Tough, will not break inside bodies AW (1).	1
(b)	 (1).	1
(c) (i)	(Moderately) concentrated hydrochloric acid/moderately concentrated sulphuric acid (1); (Heat under) reflux (1).	2
(ii)	  1 mark for each structure	2
(iii)	Any five from: Dissolve solid in minimum amount of (1); hot ethanol (1); leave to cool/evaporate (1); filter off crystals (1); wash with cold ethanol (1); dry (1); QWC (1).	6
(d)	*Cis* structures will make <u>chains</u> less regular/chains in *Cis-Trans* further apart ORA AW (1); so packing will be less regular, hence less crystalline ORA AW (1); intermolecular forces will be weaker (1); so m.pt. is lower in *cis-trans* mixture ORA (1).	4
(e) (i)	Hydroxyl/alcohol;	1
(ii)	peak at about 3300 (any suitable range) cm^{-1} /wavenumber indicates OH bond (1).	1
(f)	Add other monomers to the chain/copolymerisation AW; add plasticisers (1); *allow* introduce some *cis* bonds to lower m.pt if polymers show geometrical isomerism.	1
	Total mark	**19**

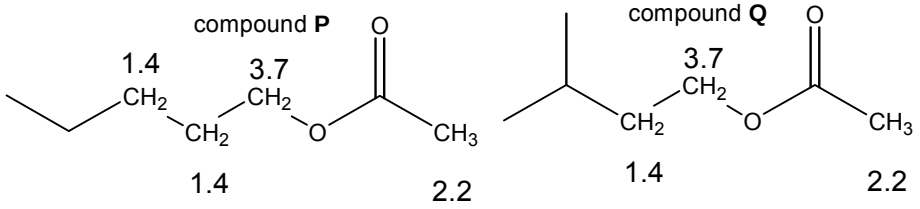
Mark Scheme Pages 2 of 5	Unit Code 2849	Session Jan	Year 2008	FINAL

Question	Expected answers	Marks
2 (a)	Phenol [*allow hydroxy(l)*] (1); amine (amino) (1); carboxylic acid (carboxyl) (1).	3
(b) (i)	Phenylalanine: yellow/orange colour (remains) *allow yellow-brown or yellow-orange* (1); tyrosine: purple (solution) (1).	2
(ii)	 (1);  (1). *DO NOT PENALISE if Na^+ ions are missing.*	2
(iii)	Contains a basic/amine group and acidic/carboxylic acid group (1); and can transfer a proton from the acidic/carboxylic acid group to the basic/amine group *allow transfer via water* (1).	2
(c)	 Correct amide link (1); correct structure (1).	2
(d) (i)	Has asymmetric carbon atom AW / chiral centre *allow chiral carbon* (1) The two isomers can not be superimposed/have different properties *e.g. rotation of plane polarised light* (1).	2
(ii)	Active sites in enzymes have specific shapes (1); only one isomer has the correct shape to fit AW(1); *allow 1 mark for'active sites are specific for one isomer'*.	2
(iii)	Change of pH changes the nature of the amine and acid groups in amino acids/proteins / changes hydrogen bonding in enzymes AW (1); So changes interactions/hydrogen bonding between enzyme and substrate/alters tertiary structure/destroys or changes shape of active site/ substrate can no longer bind AW (1).	2
(iv)	Molecules with similar shapes can fit in active sites/ Metyrosine has a similar shape to the substrate AW/methyl group replaces hydrogen so wrong shape to fit exactly / Metyrosine can fit into the active site (1); site becomes blocked (because of no reaction/held in strongly)/substrate cannot bind to active site (1).	2
(e) (i)	Rate = k (1) x [tyrosine][enzyme] (1).	2
(ii)	$Mol^{-1}\ dm^3\ s^{-1}$ *ecf* (1).	1
	Total mark	**22**

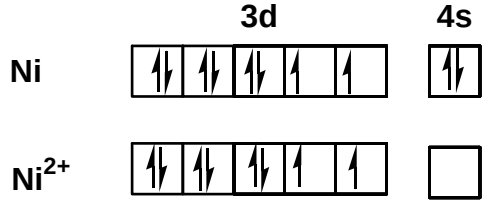
Mark Scheme Page 3 of 5	Unit Code 2849	Session Jan	Year 2008	FINAL

Question	Expected answers	Marks
3 (a)	0.78 V (1).	1
3 (b)	EITHER: People using the ancient iron-copper cell did not do their experiments under standard conditions including an example AW (1); Electrode potentials/E^0_{cell} will be different under different conditions AW (1). *OR* Solution is acid not metal ions / solution contains acid AW (1); Different reactions take place at the electrodes/ hence electrode potentials will be different AW (1);	2
3 (c)	Copper is the negative electrode = FALSE **;** Copper atoms are oxidised in the reaction = FALSE; Electrons move through the wire from the copper electrode = FALSE; Electrons do not move through the solution = TRUE; *all four correct* (2); *any two correct* (1).	2
3 (d)	Hydrogen electrode (gas, acid, Pt) (1); voltmeter *connected to electrodes* (1); salt bridge *dipping in both solutions (include Cu^{2+} half-cell) and labelled* (1); standard conditions, two from: 1 mol dm^{-3}, 298 K, 1 atmosphere (1).	4
3 (e)	$H_2(g) + Cu^{2+}(aq) \rightarrow 2H^+(aq) + Cu(s)$ Species correct (1); balanced and direction correct *ignore electrons not cancelled* (1); state symbols correct (1).	3
3 (f)	Yes, Cu is a stronger reducing agent than Fe^{2+} ions since Cu has more negative electrode potential (2) AW ORA 1 mark only if ***either*** redox property *(in terms of redox words or electron transfer)* ***or*** electrode potential data is given in the answer.	2
3 (g) (i)	  1 mark each DO NOT ALLOW –OH.	2
3 (g) (ii)	Acidity is caused by loss of protons/ H^+ /dissociation of molecule (1); (strength of acid/equilibrium position) depends on stability of anion AW COMPARISON MARK (1); anion from ethanoic acid can delocalise the negative charge and is more stable (1); $C_2H_5O^-$ is not stabilised/charge not delocalised AW (1).	4
	Total mark	**20**

Mark Scheme Page 4of 5	Unit Code 2849	Session Jan	Year 2008	FINAL

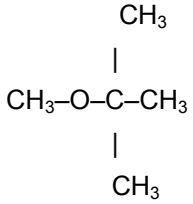
Question	Expected answers	Marks
4 (a)	Pentyl (1) ethanoate (1)	2
(b) (i)	K_c = [**P**].[water]/[acid].[alcohol] (1); At equilibrium [**P**] = [water] *may be inferred from* [**P**] = √ number (1); [**P**]^2= 4.15 x (1.06) x (1.06) (1) *ecf if incorrect K_c expression written*; [**P**] = 2.16 mol dm^{-3} answer must be to *3 sfs ecf* (1). *If water is missed out in equation 4.66 gets 2 marks.*	4
(ii)	Product/ester lost (1); concentrations of reactants will be less / concentration of water increases (1); K_c is unchanged (1); K_c does not change with concentration/only changes with temperature/ ratio of concentrations remain the same AW (1); *allow 1 mark for loss of volatile component causing an increase in temperature*.	4
(iii)	Conc. sulphuric acid/H_2SO_4 (1) *Accept conc. hydrochloric acid.*	1
(c)	Peak at 0.9 shows it has 6 methyl Hs attached to C so it is **Q** (2). OR **Q** because it alone can give a chemical shift at 1.5 (1) corresponding to the one proton AW (1).	2
(d)	 2 appropriate groups of protons with correct chemical shifts (2); 1 *mark each.* *Allow 3.6 instead of 3.7;* *include 1 mark for CH_3 at a chemical shift of 0.9/(0.8-1.2) for data given in 4(c).*	2
	Total Mark	**15**

Mark Scheme Page 5 of 5	Unit Code 2849	Session Jan	Year 2008	FINAL

Question	Expected answers	Marks
5 (a)	Corrosion resistance/stainless/hard/lustrous AW / high strength / hard AW (1).	1
(b) (i)	Magnesium sulphide/MgS (1).	1
(ii)	Coolant (oxygen blow is very exothermic)/resists, reduces or prevents 'thermal/heat shock' (1).	1
(iii)	*Any 2 from*: carbon, phosphorus, manganese, silicon (1).	1
(c) (i)	 Correct number of electrons in Ni (1); correct arrangement for Ni^{2+} (1).	2
(ii)	$3Ni + 2NO_3^- + 8H^+ \rightarrow 3Ni^{2+} + 2NO + 4H_2O$ correct reactants and products (1); balanced (1).	2
(d) (i)	Ligands cause energy levels to split (1); colour depends on difference between energy levels AW (1).	2
(ii)	$[Ni(H_2O)_6]^{2+}$ = 6 (1); $[Ni(dimethylglyoxime)_2]^{2+}$= 4 (1).	2
(iii)	$[Ni(H_2O)_6]^{2+}$ = octahedral (1); $[Ni(dimethylglyoxime)_2]^{2+}$= tetrahedral / (square) planar (1).	2
	Total mark	**14**

2850 Chemistry for Life

Mark Scheme Page 1 of 4	Unit Code 2850	Session January	Year 2008	Version Final

1 (a)	Combustion (AW) (of fuel)(1) Incomplete/ in limited supply of air or oxygen(1); if linked to CO or CO_2 and no mention of C …..zero marks incomplete combustion on own = 2 NOT unburnt fuel	2
(b) (i)	benzene/any named aromatic hydrocarbon	1
(ii)	High temp/heat of fire (1); caused nitrogen and oxygen to react/combine/join/burn/combust/oxidize (1); NOT fuse Ignore refs to engine One or other or both from air/atmosphere (1)	3
(c) (i)	ethers/alkoxyalkanes	1
(ii)	104-110º (1);(electrons) two lone pairs and two bonding pairs/ four regions/four pairs (1); around the central atom/O atom (1); (electron) (pairs)/groups/regions repel (1); to minimize repulsion/as far as possible (1); NOT bonds repel Note: maximum of 4 if no mention of electrons	5
(iii)	minimum 	1
(iv)	(5 × –394) + (6 × –286) (1); process i.e. products – reactants(needs numbers) i.e.-3686 –(–283) (1); value with sign (1); –3403 scores all ecf's as appropriate (+3403 = 2marks; 3403 = 1 mark if shown without working)	3
(d)	entropy increases (1); if decrease 0 marks for question No. of ways of arrangement/combinations/ disorder/randomness increases (1); NOTE need comparison ie more ways etc NOT more molecules/atoms	2
		Total = 18

Mark Scheme Page 2 of 4	Unit Code 2850	Session January	Year 2008	Version Final	
2 (a) (i)	lithium carbonate				1
(ii)	Any two from…. formula mass for LiOH less ora ; need to carry as low a mass as possible/AW sodium hydroxide deliquescent; can carry more moles of lithium hydroxide; NOT LiOH is more corrosive				2
(b) (i)	$LiH(s) + H_2O(l) \rightarrow LiOH/LiHO/Li(OH)(aq) + H_2(g)$ equation correct (1); state symbols correct (1); accept multiples				2
(ii)	$[Li]^+ [{}^{*}_{x} H]^-$ no electrons (allow 2) on Li (1); two different on H (1); both charges (1); correct structure and charges for sodium hydride is one mistake…gets 2 marks				3
(iii)	<table><tr><td>sub-atomic particle</td><td>number of sub-atomic particles in H^-</td></tr><tr><td>proton(s)</td><td>1</td></tr><tr><td>neutron(s)(1)</td><td>0</td></tr><tr><td>electron</td><td>2(1)</td></tr></table>				2
(iv)	$Li(g) \rightarrow Li^+(g) + e^-$ state symbols as above(1); ionisation correct(1) I[illegible]sotopic[illegible]ers on Li CON on electron. No ss on electron				2
(v)	**assume 'it' to be Li** outer electrons(1); nearer nucleus/smaller atom/fewer shell[illegible]great[illegible]action(1)[illegible]der to lose/more energy needed to rem[illegible]; ***allo[illegible]elding[illegible]ments must be compara[illegible]a*** **reference to 'force' must be in terms of attraction**				4
(c) (i)	cation/positive res[illegible]ositive metal ions(1); <u>delocalized/sea[illegible]ctrons</u> (1); NOT protons/lithium [illegible]s e e e e e no mark for the lattice this time so e a minimum of e				2
(ii)	electrons free to <u>move/flow/transfer/</u> through structure NOT 'floating electrons'				1
					Total =19

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3 (a) (i)	**2**B(**s**) + **3**H_2O(**g**) → B_2O_3(**s**) + **3**H_2(**g**) balancing, allow multiples(1); states(1);		2
(ii)	B_2O_3 + 3Mg → 3MgO + 2B (not B_2) reactants & products(1); balancing based on products of magnesium oxide and boron(1)		2
(b) (i)	moles of H_2 = 5000/2(2500) (1);		1
(ii)	moles of B = 2/3 of H_2(1666.6) this mark for use of their(ecf) eqn. to get ratio (1); 1666.6 ecf on their eqn x 11(18300)(1); → 20/18.3/18⅓ kg(1) ecf's		3
(iii)	2500 x 286 (715000 kJ) ecf		1
(c) (i)	2NO + 2CO ➔ N_2 + 2CO_2 formulae (1); balancing (independent) providing reactants correct(1) eg NO + CO ➔ N + CO_2 ..... gets 1 mark		2
(ii)	Reactants adsorbed or bonded/chemisorbed on catalyst <u>surface</u> AW (1); absorbed CON Bonds in reactants (weaken and) break (1); NOT bonds between reactants New bonds form in product/new molecules (1); Desorbed/diffuse off surface AW (1); NB last or first two pairs reversed only 1 mark in either pair (Diagrammatic acceptable)		4
(iii)	No CO (1); BOD H_2O won't react with NO Not unreacted hydrogen will not react with NO		1
(d)	*Advantages* <u>No</u> CO/C emissions/only produces water/no pollutants ***(if qualified)***/less pollutants/renewable/high energy density/plentiful supply/less use of fossil fuels(AW) (1); Not NO reduced *Disadvantages* storage issues (BOD liquefied)/delivery system (1) NOT NO not reduced		2
(e)	same group (of PT)/same outer electron structure(1); reacts in a similar way/similar properties AW (1); in same period therefore reacts in similar way CON..zero.		2
			Total = 20

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4 (a) (i)	alkane(s) NOT 'linear' alkanes		1
(ii)	3-ethyl-2-methylheptane heptane (NOT cycloheptane)(1); all correct(ignore dashes and commas) (1);		2
(iii)	**A** and **C** only(1); same molecular formulae/same number and type of atoms/same atoms(1); different structural/structure/arrangement of atoms(1); NOT different shape or chemical formulae		3
(iv)	$C_{15}H_{32}$ carbons(1); hydrogens(1);		2
(v)	**B** (1);		1
(b) (i)	**D**		1
(ii)	**A** or/and **C** **(A and D or A,C and D CON)**		1
(c)	more efficient/more power generated/reduces/lowers tendency(1); knock/pre-ignition/autoignition (1); NOT no or prevents auto ignition.		2
(d) (i)	1000/170(1); x 8062 ecf on some attempt to calculate moles (BOD)(1); sig figs(1) only scores if some working; 47,000 scores all three. Ignore minus sign		3
(ii)	108000/47000 = 2.3(1) ecf from (i)		1
(iii)	ensures complete combustion;		1
			Total = 18

2854 Chemistry by Design

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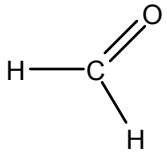
1 (a) (i)	$CH_3OH + 0.5O_2 = HCHO + H_2O$ *or doubled*				1
(ii)					1
(b) (i)	greater yield (1); <u>equilibrium</u> (position) moves to oppose change/ moves in endothermic direction (1) *mark separately*				2
(ii)	smaller yield (1); <u>equilibrium</u> (position) moves in direction of fewer molecules (1) *mark separately*				2
(c) (i)	pH_2 (x) $pHCHO/pCH_3OH$ (1) atm (1) *allow square brackets IF "p" as well*				2
(ii)	$p = K_p \times pCH_3OH/ pH_2$ *(or substituted)* (1) *ecf from incorrect answer to c i* $= 6.4(4) \times 10^{-3}$ (1) *ecf from first marking point.* *Correct answer from (c)(i) scores 2.*				2
(d) (i)	$NaBH_4$ *or correct name; otherwise ignore name*				1
(ii)	nucleophilic (1); addition (1)				2
(e)	15 – CH_3^+ 28 – CO^+ 29 – CHO^+ (accept COH^+) 30 – CH_2O^+ 31 – CH_3O^+ 32 – CH_4O^+/ CH_3OH^+ 33 – $C^{13}H_4O^+$/ $C^{13}H_3OH^+$ *Allow C,H,O in any order for all* any two: (1) each; + sign (1) *award if ONE ion correct*				3
					16

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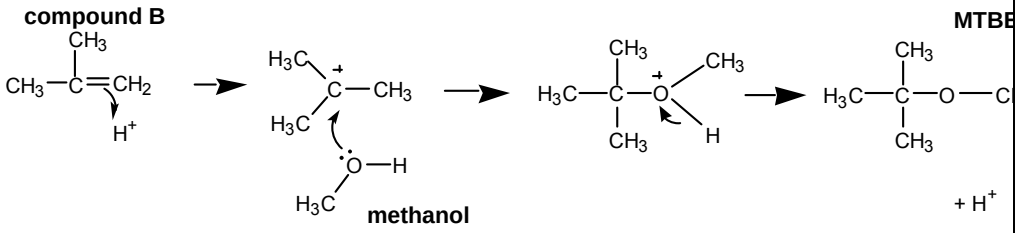
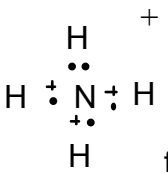
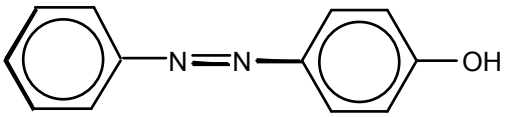
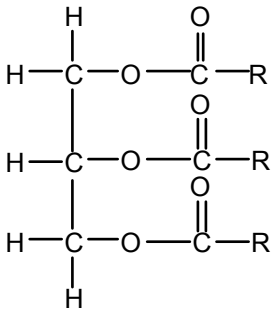
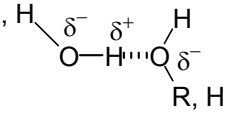
Question	Expected Answers	Marks
2 (a) (i)	reduce knocking/reduce pre-ignition/raise octane rating/cause more complete/efficient combustion (AW)/ make more combustible/ provides more oxygen for combustion	1
(ii)	ether	1
(b)	using M_r = 88 to convert solubility to g dm^{-3} (44) or lowest concentration to mol dm^{-3} (4.5×10^{-8}) (1); ratio = 1(.1) x 10^7:1/ 1: 1(.1) x 10^7 *Allow 1: 9/ 9.09/9.1 x 10^{-8}/ 9/ 9.09/9.1 x 10^{-8}:1 Allow ecf* 1 sf *provided some calculation* (1)	3
(c) (i)	structural/functional group	1
(ii)	2-methylbutan-2-ol (2); *ignore dashes and gaps. omission of either or both "2" scores 1. (1,1)dimethylpropan-1-ol scores 1*	2
(iii)	*four from:* MTBE has permanent dipole–permanent dipole /instantaneous dipole-induced dipole *allow abreviations*; compound A has hydrogen bonding; because it has an O–H group/ is an alcohol; hydrogen bonds are <u>stronger</u> (than permanent dipole–permanent dipole/i-d–i-d) *ora*; more energy is required to separate the molecules/ boil compound A	4
(iv)	(sulphuric) acid potassium dichromate/dichromate* *or correct formulae* (1); heat/ reflux *depends on dichromate (name or formula) being mentioned* (1); turns green (1); compound A is a tertiary alcohol *or description* (1) * or dichromate(VI), *other oxidation numbers are CON*	4
(d) (i)	alkene	1
(ii)	 4 ex 5: each arrow and each charge (*if single headed arrows, allow second and subsequent appearances)*; *extra arrows or charges are CON to the mark for the molecule concerned*	4
(iii)	addition (1) electrophilic (1)	2
(iv)	H^+ (1); recycled/ goes in at start, out at end (AW) (1) *mark separately*	2
(e)	nmr: *two from:* two environments/ratio 1:3/CH_3C at 1.2, CH_3–O at 3.2 *ignore O-H*; *relate to compounds*: not D/ it is MTBE or C (from environments.)/ MTBE from ratio (1) ir: no O-H (*ignore references to C-O and C-H)* (1) *relate to compounds*: not C/it is MTBE or D/ MTBE to confirm nmr (1) *MTBE must be named as the compound to score the fifth mark*	5
		30

Mark Scheme Page 3 of 5	Unit Code 2854	Session January	Year 2008	Version Final	
3 (a) (i)	nitrogen/ air(1); methane/ natural gas (1); water/steam (1)				3
(ii)	$NH_3 + HNO_3 \rightarrow NH_4NO_3$				1
(iii)	$HNO_3 \rightarrow H^+ + NO_3^-$ *or with* H_2O *to form* H_3O^+				1
(b)	 four electron pairs (1); dative bond and plus sign (somewhere) (1)				2
(ii)	109 (^{o}) (1); 4 electron pairs/ bonds/ areas of electron density (AW) *no ecf* (1); repel and get as far away from each other as possible (1)				3
(iii)	soluble in water (1); <u>ions</u> attract water molecules/ <u>ions</u> are hydrated (1); conducts electricity <u>in solution</u> (1); ions free to <u>move</u> (1) *allow second mark if "conducts when molten" given* QWC: written in sentences (at least two) only one spelling, punctuation or grammatical error (see notes)				4 1
(c)	NH_4NO_3 = 80 (1) % = 28 x 100/80 = 35% *ecf* (1)				2
(d)	*two from:* nitrogen/nitrates/ammonia/ammonium needed by plants (AW); soluble; high % nitrogen; NH_4^+ held by clay/soil				2
(e) (i)	equilibrium sign *ALLOW some description of reaction not going to completion*				1
(ii)	$[NH_3]$ $[H^+]/ [NH_4^+]$ completely correct				1
(iii)	$[H^+] = [NH_4^+]$ *stated or implied* (1) $[H^+] = 2.37/2.4 \times 10^{-6}$ (1);				2
(iv)	pH = 5.6/5.62/5.63 *ecf from some calculated value in 3 e iii*				1
(f) (i)	any soluble ammonium salt (1) ammonia (solution) / ammonium hydroxide/ NH_3/ NH_3(aq) (1)				2
(ii)	$[NH_4^+] = [NH_3]$ so $[H^+] = K_a$ (1); pH = $(-\log(5.6 \times 10^{-10}) = 9.25/9.3$ *(If* $(NH_4)_2SO_4$ *used in 3fi, then allow this answer or* $[H^+] = 2K_a$*; pH = 8.95/9.0)*				2
					28

Mark Scheme Page 4 of 5	Unit Code 2854	Session January	Year 2008	Version Final	
4 (a) (i)	nitrobenzene *allow 1-nitrobenzene/ nitro-benzene/ nitro benzene*				1
(ii)	conc sulphuric acid (1); conc nitric acid (1); *conc (allow "c.") only needs to be mentioned once – nitric acid and sulphuric acid (no conc) score (1)* below 55 ^{o}C (1) *reflux is "CON"*				3
(iii)	Sn + c,HCl reflux (1)				1
(iv)	C_6H_{14} = C_6H_6 + $4H_2$ hexane formula (1) balanced equation for the reaction of a hydrocarbon producing H_2 and benzene(1)				2
(b) (i)	$AlCl_3$ (1); anhydrous/reflux (1)				2
(ii)	(neutral) iron(III) (chloride) (1); purple/ pink/ mauve/ violet (1) *mark separately, ignore starting colour*				2
(iii)	use of ratio 78/94 (either way up) (1) 87% (1) *ecf*				2
(c) (i)	alkaline solution (1); below 5 ^{o}C (1)				2
(ii)	 completely correct (2); one error (1)				2
(d)	larger chromophore/ lone pair on nitrogen (involved in delocalisation)/ more delocalisation / NH_2 group				1
(e)	benzene absorbs uv/ does not absorb visible (1); *four from:* dye absorbs in visible; transmits complementary colour; electrons excited/ move to higher energy levels; more delocalisation in dye/ longer chromophore; less energy needed for excitation/ energy levels closer; (Δ)E = hv/ frequency is proportional to energy change; *max two ex four for emission of light* QWC: Logical, with three words from list below used correctly: (2) Logical with two words from list below used correctly (1) absorbs; transmits; visible; uv; electrons excited; delocalisation; chromophore; (electron) energy level, complementary				5 2
					25

Mark Scheme Page 5 of 5	Unit Code 2854	Session January	Year 2008	Version Final	
5 (a)	 glycerol backbone with 3 O atoms (1) rest (1) ester link reversed (with rest correct) scores (1)				2
(b) (i)	instantaneous (dipole) - induced dipole (1) *only*				1
(ii)	Mixed system has more disorder / more ways of arranging the particles/molecules (1);				1
(c) (i)	similar intermolecular forces/ id – id (*allow abbreviations here)*/ both non-polar				1
(ii)	*three from:* high K_{ow} means more pesticide in octanol/fat (than in water); the damage to the insect is done in the fatty layers (AW); pesticide can pass from (spraying) solution into insect; small amounts needed;				3
(d) (i)	$RCOO^-$ (1) *ignore* Na^+ *NOT O–Na* R'OH (1) *or more displayed for both*				2
(ii)	 bent water with hydrogen bond to O, or H of O–H *of molecule from 5di*(1); lone pair along hydrogen bond (1); partial charges (allow just one $\delta-$ on one oxygen)(1); O–H–O straight (1) *allow last three for any hydrogen bond*				4
(iii)	**X** (*not necessarily "–")* surrounded by at least three water molecules (1); water molecules bent and correctly aligned, both Hs towards **X**. *ecf from +ve organic ion*(1);				2
(e) (i)	A – lattice enthalpy (1); B – sum of *depends on next*(1); enthalpy(ies) of hydration/solvation (of ions) (1); C – enthalpy (change) of solution (1) *allow symbols, eg* ΔH_{LE} *"enthalpy" missing scores after first omission*				4
(ii)	+3 (1)				1
					21

Grade Thresholds

Advanced GCE Chemistry (Salters) (3887/7887)
January 2008 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u
2848	Raw	90	70	62	54	46	39	0
	UMS	120	96	84	72	60	48	0
2849	Raw	90	68	60	53	46	39	0
	UMS	90	72	63	54	45	36	0
2850	Raw	75	57	50	43	37	31	0
	UMS	90	72	63	54	45	36	0
2854	Raw	120	84	75	66	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 (ie 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	12.2	35.3	61.1	82.3	96.4	100	569
7887	15.0	48.8	75.0	92.5	98.8	100	84

653 candidates aggregated this series

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

Statistics are correct at the time of publication.

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