OCR
RECOGNISING ACHIEVEMENT

GCE

Chemistry (Salters)

Advanced GCE **A2 7887**

Advanced Subsidiary GCE **AS 3887**

Mark Schemes for the Units

June 2007

3887/7887/MS/R/07

Oxford Cambridge and RSA Examinations

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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 should be read in conjunction with the published question papers and the Report on the Examination.

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MARK SCHEME ON THE UNITS

Mark Scheme 2848
June 2007

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

1. Please ensure that you use the **final** version of the Mark Scheme. You are advised to destroy all draft versions.

2. Please mark all post-standardisation scripts in red ink. A tick (✓) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If two (or more) responses are required for one mark, use only one tick. Half marks (½) should never be used.

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   ^ = omission mark
   bod = benefit of the doubt (where professional judgement has been used)
   ecf = error carried forward (in consequential marking)
   con = contradiction (in cases where candidates contradict themselves in the same response)
   sf = error in the number of significant figures

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Abbreviations, annotations and conventions used in the Mark Scheme	/	= alternative and acceptable answers for the same marking p
	;	= separates marking points
	NOT	= answers which are not worthy of credit
	( )	= words which are not essential to gain credit
		= (underlining) key words which **must** be used to gain credit
	ecf	= error carried forward
	AW	= alternative wording
	ora	= or reverse argument

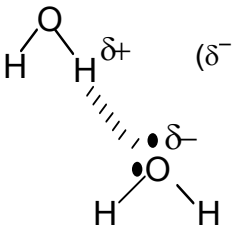
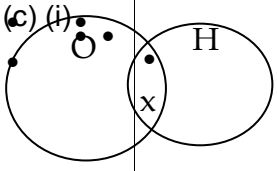
Mark Scheme	Unit Code 2848	Session June	Year 2007	Version Final

Question	Expected answers	Marks
1 (a)	The polymer is an (electrical) insulator (heat is CON)/ prevent electric shock AW (1) IGNORE references to corrosion.	1
1 (b) (i)	Froth flotation (1)	1
1 (b) (ii)	*Any TWO from*: Grains* are given water repellant/waterproof/ hydrophobic coating AW (1); (Air and detergent cause the mixture to) froth/ grains attached to air bubbles (1); Grains* are concentrated (*AW*) in the froth/ rise to surface with air bubbles (1); Ore grains scooped (*AW)* off the surface (must be implied) with froth (1) *grains/minerals/copper/ore/metal CON molecules once	2
1 (c) (i)	Cu_2S (1)	1
1 (c) (ii)	$Cu_2S + O_2 \rightarrow 2\ Cu + SO_2$ LHS – copper sulphide (ecf from c(i)) plus O_2 (1) Completely correct (with ecf if necessary) (1)	2
1 (c) (iii)	sulphuric acid/ H_2SO_4 (1)	1
1 (d) (i)	Solid collects on filter paper (can be labelled on diagram) *AW* (1); suction/vacuum (can be labelled on diagram) makes the process faster AW (1)	2
1 (d) (ii)	S^{2-} *only* (1)	1
1 (d) (iii)	RMM $CuSO_4$ = 159.5 (1); $\frac{100 \times 63.5}{159.5}$ (1) (ecf from RMM); = 40 g (2s.f.) (1) (*Any worked out answer to 2sf)*	3
	Total	**14**

Mark Scheme	Unit Code 2848	Session June	Year 2007	Version Final

Question	Expected answers	Marks
2 (a) (i)	Oxidation state of sulphur in: Oxidation state of iodine in: SO_2 ..... = +4 (1) I_2 = 0 (1) SO_4^{2-} ..... = +6 (1) I^- = -1 (1) *MAX 3 if all signs are after the numbers*	4
2 (a) (ii)	Oxidised, as the (S) oxidation state has increased/ oxygen added/ loses electrons (1) (ecf from (i) if oxidation state goes down and this is given as reason)	1
2 (b) (i)	Brown/orange/yellow (or combination thereof. Red with one of these but not on its own) (1) to colourless (1) (*NOT clear*)	2
2 (b) (ii)	16.20 × 0.0100 (1) / 1000 and evaluate (1) (= 1.62×10^{-4} mol)	2
2 (b) (iii)	answer from b(ii) or 1.62×10^{-4} mol (1)	1
2 (b) (iv)	answer from b(iii) / 50 (1) ×1000 and evaluate (1) (3.24×10^{-3} mol dm^{-3} (2))	2
2 (b) (v)	SO_2 = 64 (1) 64 (ecf) × answer to b(iv) and evaluate (1) (0.207g dm^{-3} (2)) ALLOW 2–4 sf	2
2 (b) (vi)	*Comment will depend upon the answer from (b)(v). Any ONE from:* *if ans (b) (v) < 0.01 g dm^{-3}* then wine goes off / below minimum (1); *if 0.01 g dm^{-3} < ans (b) (v) < 0.25 g dm^{-3}* within range (AW)/ wine preserved (1); *if ans (b) (v) > 0.25 g dm^{-3}* then wine tastes of SO_2 / above maximum (1)	1
	Total	**15**

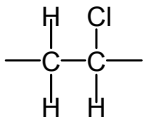
Mark Scheme	Unit Code 2848	Session June	Year 2007	Version Final

Question	Expected answers	Marks
3 (a)	Halogenoalkanes / haloalkanes(1)	1
3 (b) (i)	 (δ^- can be shown on either O) Water molecule shape drawn correctly (1); (lose this mark if HO_2 but can score others) Lone pair on relevant O pointing along bond (1); Partial charges shown, one O (shown δ^-) and one H (shown δ^+) (1); O–H–O straight (1)	4
3 (b) (ii)	Non-bonding/lone/unshared pair on oxygen / oxygen atom small* & electronegative (1); hydrogen with δ^+ charge / H in polarised O–H bond (*or very/high electronegativity)	2
3 (b) (iii)	Permanent dipole–(permanent) dipole	1
3 (b) (iv)	• Imf between chloromethane molecules are weaker than imf/hydrogen bonds between water molecules (1); • bromomethane imf stronger than chloromethane imf (1); These are i.d.–i.d./ caused by more electrons/bigger molecules/ higher M_r (1)	3
3 (c) (i)	 Correct bond between O and H (1) Two lone pairs and one unpaired electron on O (1) *charge is CON to this mark*	2
3 (c) (ii)	Homolytic/ homolysis (1) IGNORE photodissociation	1
3 (c) (iii)	uv (1); Sun (1)	2
3 (c) (iv)	$H_2O + O \rightarrow 2\ OH$ (1)	1
3 (c) (v)	Propagation (1); termination (1)	2

3 (d) (i)	$CH_3Cl + H_2O \rightarrow CH_3OH + HCl$ correct species on LHS (1); completely correct (1) Ignore CH_3Br on LHS. ALLOW CH_4O on RHS.	2
3 (d) (ii)	Methanol (1) No ecf	1
3 (d) (iii)	Nucleophilic (1); substitution (1) Extras CON	2
3 (e) (i)	C–Cl, because Cl more electronegative (than Br). Ignore comparisons with carbon(1)	1
3 (e) (ii)	C–Cl, because Cl has a smaller atomic core/ is smaller/ shorter bond (than Br) (1)	1
3 (e) (iii)	Bond strength, because the bromomethane reacts faster (and has the weaker/ more easily broken C–Hal bond) (1) Ignore other reasoning. No ecf.	1
3 (f) (i)	$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ Correct species (1); balancing *depends on first* (1) IGNORE state symbols	2
3 (f) (ii)	(Reaction in equation 3.3 requires energy for a bond to be broken but) (reaction shown by) equation 3.4 has no bond breaking/ <u>only</u> bond formation (1)	1
	Total	**30**

Mark Scheme	Unit Code 2848	Session June	Year 2007	Version Final

Question	Expected answers	Marks
4 (a)	Fractional distillation/ fractionation (1)	1
4 (b)	Increasing the temperature (makes the reaction faster) (1); At higher temperatures the particles have more (kinetic) energy/move faster/ vibration/ more frequent collisions (1); More particles have an energy greater than the activation enthalpy when they collide (1); Increasing the pressure (makes the reaction faster) (1); At higher pressures there are more particles per unit of volume/ closer together (1); So more frequent collisions / more likely to collide/ collide more often/ greater chance of collision (1) QWC: logical, correct use in context of at least three terms below: molecule; particle; activation enthalpy/energy; kinetic/ vibrational energy; collisions; rate	6 1
4 (c) (i)	Equilibrium moves to oppose change (AW) (1); Increasing the temperature pushes (the position of) equilibrium* in the endothermic direction/ direction that uses energy (1); * *can be assumed if mentioned in first mpt* So increasing the temperature will increase the yield of ethene (1)	3
4 (c) (ii)	Increasing the pressure pushes (the position of) equilibrium towards the side with fewer molecules/ smaller volume (1); So increasing the pressure will decrease the yield of ethene (1)	2
4 (d) (i)	Conducting polymers /poly(ethyne) /Teflon/ PTFE/ Bakelite (1)	1
4 (d) (ii)	Addition (1) NOT additional	1
4 (d) (iii)	*Any ONE from*: (Food/carrier) bags (1); can be rolled into thin films (1); Coating electrical wires (1); good electrical insulator (1); Washing up bowls, etc. (1); can easily be moulded into complicated shapes (1) *Other sensible suggestions* *Property must match use NOT strong or cheap anywhere*	2
4 (d) (iv)	Softens/ flows/ melts/can be remoulded when warmed/ heated (1)	1
4 (e) (i)	$2Cl^- \rightarrow Cl_2 + 2e^-$ (ALLOW e for electron symbol) Correct species (1); balancing *depends on first* (1) NOT $Cl^- \rightarrow Cl + e^-$	2

4 (e) (ii)	(Partially) positively charged/electron deficient reagent/attracted to areas of high electron density (1); Bonds by accepting a pair of electrons (can be shown via mechanism) (1); Two molecules react to form <u>one</u> product (aw) (1)	3
4 (f) (i)	Hydrogen chloride/ HC*l(unless (aq))* (1) IGNORE hydrochloric acid	1
4 (f) (ii)	Different arrangement (of groups) around a (carbon–carbon) double bond (AW) Allow from diagram (1) ALLOW other centres of restricted rotation	1
4 (g) (i)	 IGNORE brackets and *n*. (must have terminal bonds)	1
4 (g) (ii)	Regions have a high degree of order/ regular/ chains more aligned (1); the chains move over each other less easily (1); because there are <u>stronger</u> imf (1); (IGNORE "more imf") due to molecules being closer together (1) QWC: two sentences; spelling, punctuation and grammar correct. *(1 error allowed)*	4 1
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Mark Scheme 2849
June 2007

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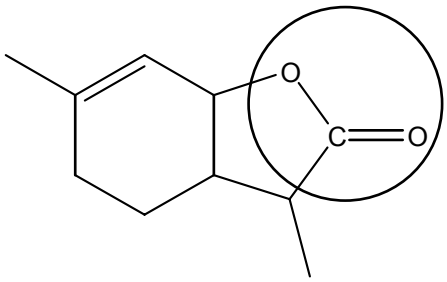
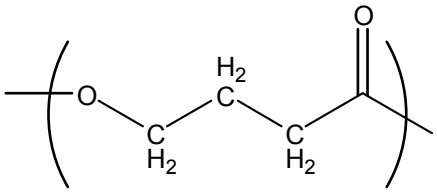
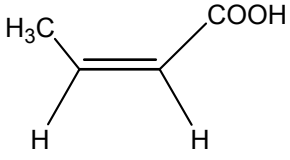
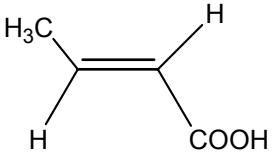
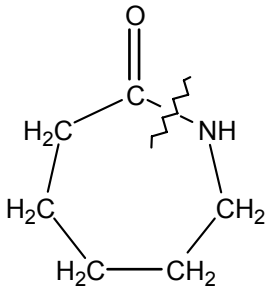
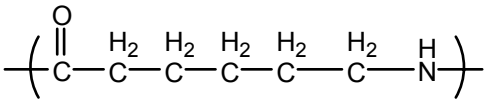
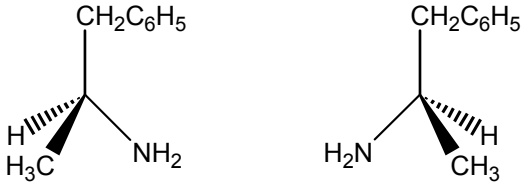
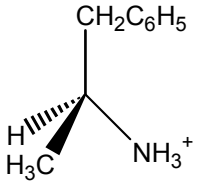
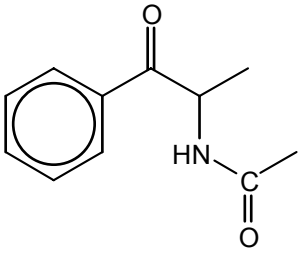
1 (a)	 (1).	1
1 (b)	3	1
1 (c)	(Expose to) iodine (vapour)/uv radiation (1).	1
1 (d) (i)	166	1
1 (d) (ii)	CH_3 (1) $^+$ charge on formula (1).	2
1 (d) (iii)	1.0 R–C**H**$_3$ 1 1.6 C=C–C**H**$_3$ 1 1 mark each for correct protons (2); 1 mark for correct intensity ratio allow 3:3 (1).	3
1 (e) (i)	Conc. sulphuric acid absorbs water (By Le Chatelier's principle) equilibrium position moves to the right (1).	2
1 (e) (ii)	 1 mark for ester ends either separate or together; 1 mark for the rest correct.	2
1 (e) (iii)	Elimination / dehydration (1);  and  (1) *Cis-trans* isomers / 2 non-equivalent groups on each C of the C=C bond / different spatial arrangements of the groups / COOH and CH_3 groups can be in different positions (1); restricted rotation about a double bond AW (1).	4
	Total	**17**

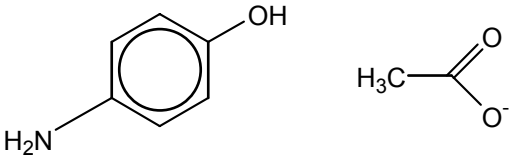
Mark Scheme	Unit Code 2849	Session June	Year 2007	Version Final

Question	Expected answers	Marks
2 (a) (i)	+4 (1) *accept 4+*.	1
2 (a) (ii)	0.32 V (1); Cd (half-cell) because the Cd half-cell gains electrons from the Ni half-cell / electrons move to the positive electrode AW ORA (1).	2
2 (a) (iii)	$Cd(OH)_2 + Ni(OH)_2 \rightarrow Cd + NiO_2 + 2H_2O$ Correct reactants (1); correct products and balanced (1); *wrong way round but balanced (1).*	2
2 (a) (iv)	Concentration of solutions = 1 mol dm^{-3} /1 M/1 molar (1); temperature 298 K/25°C and pressure = 1 atmosphere *or equivalent (10^2 kPa)* (1).	2
2 (b) (i)	 (1)	1
2 (b) (ii)	 Chain contains a secondary amide linkage (1); rest correct (1).	2
2 (b) (iii)	Water formed in the condensation (1) replaces the water used up in the hydrolysis (1). *or* condensation and hydrolysis cancel out AW (2).	2
2 (b) (iv)	Nylon has hydrogen bonding (1); whereas poly(ethene) has (instantaneous dipole-induced) dipole forces (1) *allow Van der Waals forces;* hydrogen bonding is much stronger / more energy needed to separate polymer chains AW (1).	3
	Total	**15**

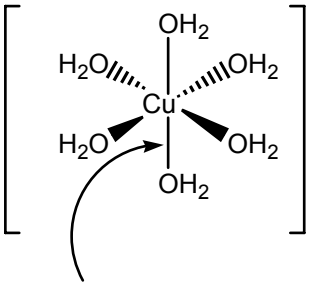
Mark Scheme	Unit Code 2849	Session June	Year 2007	Version Final

Question	Expected answers	Marks
3 (a)	 *1 mark for showing correct groups on one structure;*	2
3 (b) (i)	 *The mark is for the* NH_3^+ *on any type of correct structure/formula* (1).	1
3 (b) (ii)	Solvent dissolves amphetamine when hot but not when cool AW/ boiling point of solvent is lower than solid's m.pt. (1); use (minimum amount of) hot/warm solvent AW (1); leave/cool to crystallise (1); filter off crystals and dry (1).	4
3 (b) (iii)	Tablets are easier for controlling dosage / soluble therefore will be quicker acting/get into bloodstream more easily / may not have amphetamine's side effects (1).	1
3 (c) (i)	Carbonyl/ketone (1); Amine / amino (1).	2
3 (c) (ii)	Strong peak around 1720 cm^{-1} (1) indicates **C=O** in ketone therefore cathinone (1); *or* no broad peak at about 3600 cm^{-1} (1); indicates no **OH** present therefore cathinone (1);	2
3 (c) (iii)	 (1).	1
3 (d)	Active sites on enzymes have specific shapes (1); Only one stereoisomer has the complementary shape to fit into the site AW (1); at low temperatures there is not enough energy / more energy at higher temperatures (1); to overcome the <u>activation</u> energy for the reaction AW (1); at high temperatures the interactions holding the enzyme structure together are broken/tertiary structure/active site shape changes (1). QWC *see separate sheet for detailed information for awarding this mark* (1)	6
	Total	**19**

Mark Scheme	Unit Code 2849	Session June	Year 2007	Version Final

Question	Expected answers	Marks
4 (a) (i)	Both half-lives are about 3400–3800 s (1 mark each); construction lines shown on graph (1).	3
4 (a) (ii)	First order (1); constant half-life (1).	2
4 (a) (iii)	Rate = k × [paracetamol] (1); ecf s^{-1} (1). ecf	2
4 (a) (iv)	Graph extrapolation (4 hours =14400 s) (1); 0.05–0.06 g / 50–60 mg(1) *ecf for incorrect time conversion*. *Accept no units but not incorrect units.*	2
4 (b) (i)	Phenol/hydroxyl (1)	1
4 (b) (ii)	Iron(III) chloride (solution) (1); purple colour forms (1) *as always any shade of violet/purple, ignore starting colour.*	2
4 (c)	 1 mark each for the aminophenol/*allow* phenate ion, and ethanoic acid/ethanoate (2); 1 mark for correct ionic charge on O^- of ethanoate (1).	3
4 (d) (i)	Suitable filter/having complimentary colour of sample used in colorimeter (1); zero absorbance/transmission with water/solvent (1); measure absorbance/transmission of samples of known concentration (1); construct a calibration curve (1); read sample concentration off graph (of absorbance/transmission against concentration) (1).	5
4 (d) (ii)	Tangent of graph is drawn at time = 0 (1); gradient of tangent gives rate of reaction AW (1).	2
	Total	**22**

Mark Scheme	Unit Code 2849	Session June	Year 2007	Version Final

Question	Expected answers	Marks
5 (a) (i)	$3s^2\ 3p^6\ 3d^{10}\ 4s^1$ (*or* $4s^1 3d^{10}$) 1 mark for adding 19 electrons and orbitals named correctly (1); I mark for correct configuration (1).	2
5 (a) (ii)	4s orbital	1
5 (a) (iii)	CH_3COO^- (1)	1
5 (b) (i)	 $^{2+}$ represents dative covalent bond *or* **O:** → formula of ion including charge (1); all 6 O atoms bonded to the Cu (1); shape of ion (1); bonding given (1),	4
5 (b) (ii)	$Cu^{2+}(aq) + 2OH^-(aq) \rightarrow Cu(OH)_2(s)$ formulae correct (1) correct state symbols for a precipitation reaction (1).	2
5 (b) (iii)	Dissolves AW (1); dark/royal blue (1).	2
5 (c)	Copper(II) ions absorb red light / red light excites electrons (1); Light not absorbed/transmitted is blue (1).	2
5 (d)	Reddish brown stain is due to copper (1); this is formed by reduction of copper(II) ions (1); $E^\ominus$ for SO_2 is more negative than $E^\ominus$ for Cu(s) therefore SO_2 will reduce the copper(II) ions AW (1).	3
	Total	**17**

Mark Scheme 2850
June 2007

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

1. Please ensure that you use the **final** version of the Mark Scheme.
   You are advised to destroy all draft versions.

2. Please mark all post-standardisation scripts in red ink. A tick (3) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If two (or more) responses are required for one mark, use only one tick. Half marks ($\frac{1}{2}$) should never be used.

3. The following annotations may be used when marking. No comments should be written on scripts unless they relate directly to the mark scheme. Remember that scripts may be returned to Centres.

x	=	incorrect response (errors may also be underlined)
^	=	omission mark
bod	=	benefit of the doubt (where professional judgement has been used)
ecf	=	error carried forward (in consequential marking)
con	=	contradiction (in cases where candidates contradict themselves in the same response)
sf	=	error in the number of significant figures

4. The marks awarded for each part question should be indicated in the margin provided on the right hand side of the page. The mark total for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.

5. In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. Strike through the remainder. In specific cases where this rule cannot be applied, the exact procedure to be used is given in the mark scheme.

6. Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)

7. Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.

8. An element of professional judgement is required in the marking of any written paper, and candidates may not use the exact words that appear in the mark scheme. If the science is correct and answers the question, then the mark(s) should normally be credited. If you are in doubt about the validity of any answer, contact your Team Leader/Principal Examiner for guidance.

Abbreviations, annotations and conventions used in the Mark Scheme	/	=	alternative and acceptable answers for the same marking point
	;	=	separates marking points
	NOT	=	answers which are not worthy of credit
	( )	=	words which are not essential to gain credit
	____	=	(underlining) key words which **must** be used to gain credit
	ecf	=	error carried forward
	AW	=	alternative wording
	ora	=	or reverse argument

Mark Scheme	Unit Code 2850	Session June	Year 2007	Version Final

Question	Expected answers	Marks
1 (a)	$^{4}_{2}\alpha$(1); $^{237}_{93}$ ecf (1); ecf on proton number Np (1) NOT Americium	3
(b) (i)	α particles stopped/cannot escape from/ (1); (container mark) by container (walls)/thin foil/few cm air/paper(1) (property mark) NOT skin	2
(b) (ii)	(collide with air molecules) and knock/ remove/release electrons (off)(1)	1
(c) (i)	moles americium = 88.3/241(= 0.366) <u>and</u> moles oxygen 11.7/16(= 0.73)(1) AmO_2 (1); (just on own scores both marks) Am_2O on own – zero but ecf on upside down ratio	2
(c) (ii)	0.008 × 273(ecf on c(i) but must be correct) (1); /5000(1); = 0.0004 (1) (mark sig figs separately providing calculation present)	3
(d) (i)	<table><tr><th>isotope</th><th>protons</th><th>neutrons</th><th>electrons</th></tr><tr><td>americium-243</td><td>95</td><td>148</td><td>95</td></tr><tr><td>americium-241</td><td>95</td><td>146</td><td>95</td></tr></table> one mark for each correct column (usual ecf's)	3
(d) (ii)	$^{243}_{94}Pu$ one mark for each	2
	Total	**16**

Mark Scheme	Unit Code 2850	Session June	Year 2007	Version Final

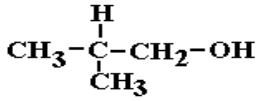
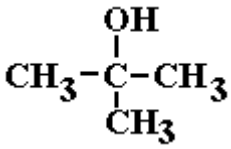
2 (a) (i)	four electrons between left O and S(1); O S O lone pairs (ecf) on S <u>and</u> O's(1) dative pair from S to right O(1)	
(a) (ii)	(three) sets of electrons(NOT bonds)(AW)round <u>sulphur/central atom</u> (1) repel(<u>electrons</u>)(1)as far as poss/<u>minimize</u> electronic energy/repulsion(1)	
(b)	all formulae correct(1) $2SO_2(g) + 2H_2O(l/g) + O_2(g) \rightarrow 2H_2SO_4(aq)$ balancing(1)(allow multiples/half); state symbols(1);	3
(c) (i)	Heterogeneous	1
(c) (ii)	costs less/metals expensive(1); big surface area(1)	2
(d) (i)	1.5(1)	1
(d) (ii)	easier to dispose/store/transport/saleable(1) NOT reduces pollution/harmful	1
(e) 5 ticks: con correct 'ticks' 6 zero	**Statement** Entropy can be thought of in terms of the number of 'ways of arrangement' of a chemical system. √ The entropy change in '**equation 2.2'** above has a positive sign. Entropy is a measure of the 'disorder' of a system. √ A substance in the solid state has higher entropy than when molten. The symbol for entropy is 'S', √ Reaction 2 is accompanied by a decrease in entropy. √	
(f)	*bond enthalpies for gaseous state/not in standard states/using mean/average bond enthalpies ora(1) NOT estimate* Do NOT allow 'not standard conditions' (in stem)	1
	Total	**22**

Mark Scheme	Unit Code 2850	Session June	Year 2007	Version Final

Question	Expected answers	Marks
3 (a) (i)	C (1); A(1); C(1); A,B,C all needed(1)	4
(a) (ii)	$C_{10}H_{16}$	1
(a) (iii)	functional group/double bond/functional group /structure/ ways in which atoms connected(AW)/what (hydrocarbon) it is(1) ; NOT type of bond	1
(b)	moles of $NaHCO_3$ = 10/84 or over 168(= 0.119/0.12)(1); mole of CO_2 half (0.06) ecf (1) answer to above x 24(= 1.4) dm^3 ecf(1) 1.4 scores all three	3
(c) (i)	decreases down group	1
(c) (ii)	removal of third/next electron breaks into inner/another (full) shell/ energy level(1); energy required prohibitive/ very hard/difficult/lots of energy needed/ electrons more strongly attracted(1) NOT atom doesn't want to lose …….	2
(c) (iii)	General reaction produces hydrogen(1); and oxide/hydroxide (1) can come from equation; calcium more reactive (ora can be implied) (1); qualifying statement which illustrates how calcium is more reactive (1) e.g. Ca reacts more vigorously with cold water/bubbles faster One balanced equation (ignore state symbols)(1);	5
	Total	**17**

Mark Scheme	Unit Code 2850	Session June	Year 2007	Version Final

Question	Expected answers	Marks
4 (a) (i)	produces <u>only</u> water on combustion/no carbon emissions/cleaner/less polluting/higher energy density/renewable/less (no) SO_x(1); (not no greenhouse gases); NOT no pollution.	1
(a) (ii)	electrolysis of water/brine etc/reaction between methane & water/cracking oil/ reforming/<u>appropriate</u> metal + water/sodium hydride (not Powerballs alone) (1);	1
(a) (iii)	fossil fuels used in power stations to generate the electricity/ fossils fuels used directly (NB must be <u>linked to a sensible answer</u> to a ii above) electricity not generated from a renewable source	1
(b) (i)	$[Na]^+$ (1); (allow eight electrons the same around the Na^+).bracket not necessary $[H^{\times}_{\bullet}]^-$ (1); (two different around H^-) ions must clearly be separate	2
(b) (ii)	$NaH + H_2O \rightarrow NaOH + H_2$ one mark for left side; one for right; (not HO) one side incorrect but balanced correctly (1) formulae correct but not balanced correctly is con therefore 1 mark.	2
(b) (iii)	NaOH corrosive/harmful/<u>strongly</u> alkaline(basic)/high pH 12+ (1)	1
(c) (i)	measure of tendency/how easy/probability(AW)(1);to auto ignite (AW)(1)	2
(c) (ii)	<u>Pattern</u> (max. 2): longer chain/more atoms, greater enthalpy change (AW) (1) (not decreases); (directly) proportional/ same increase (AW)(1); <u>Reasons</u> (max. 2): more bonds broken; more bonds formed; <u>same</u> number and <u>same</u> type; <u>Final mark</u> extra CH_2 unit/structural fragment(AW)could be in 'pattern' answer	5 max.
(c) (iii)	same <u>molecular/</u>atoms/type <u>and</u> number formula different structural (AW) (1);	1

(c) (iv)	 *methylpropan-1-ol*  *methylpropan-2-ol* (ecf names on butanol structures) correct <u>full</u> structures i.e. <u>all C–H bonds shown</u> (allow OH) (one each); correct names (one each) ecf alcohol structure (allow 2-methyl)	**4**
	Total	**20**

Mark Scheme 2852/01
June 2007

Salters Advanced Chemistry Open Book

Guidance for Examiners

These notes are to help you to apply the mark scheme. Please use the final standardised mark scheme as your main reference document.

1. ANNOTATION OF SCRIPTS

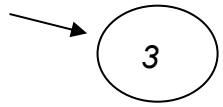
No comments should be written on scripts unless they relate directly to the mark scheme.

1.1 Summary

- **Tick** where you award a mark (max. 4). (If sentences are not used, deduct one mark).
- Put a **ringed total** at the end of the summary.
- Transfer the total to the **front of the script**.
- Check the candidate's declared **word count**.

1.2 Chemistry and Evaluation

- **Tick** where you award a mark.
- Write the mark code e.g. '3a' in the **right hand margin** of the script.
- Put a **ring** around chemistry codes.



- **Underline** evaluation codes: *12a*
- Use the **left hand margin** for any other notes you make (see 1.4 '*Helpful Abbreviations'* below).
- Add up the **total chemistry and evaluation marks** and transfer to the **grid**.

1.3 Research and Communication

- Use the **left hand margin** to highlight evidence to support your awarding of *Research* and *Communication* marks e.g. *S* for a spelling error (see *Sections 2* and 3 below).

1.4 Helpful Abbreviations

X	incorrect chemistry
^	omission / 'not enough'
Bod	benefit of the doubt
Nbod	not benefit of the doubt
ecf	error carried forward
Con	contradiction
wavy line	irrelevant material
R	repetition
A	annotation of source
S	spelling error
G	grammatical error
T	technical term error
E	equation

CHECKERS' RESPONSIBILITIES.

You need to brief your checker to check that the marks you have awarded have been **correctly processed** to give the correct total on the MS2.

Your checker needs to:

1. Count up the number of **ringed codes** in the right hand margin. This total should agree with the total for **Chemistry** on the front of the script.

2. Count up the number of **underlined codes** in the right hand margin. This total should agree with the total for **Evaluation** on the front of the script.

3. Check your addition for **Research and Communication** marks on the front of the script.

4. Check that the marks have been added to give a **correct overall total**.

5. Either: Check that the total has been **correctly transferred** to the correct candidate on the MS2 and that the **computer coding** lozenges have been correctly filled in.

CHEMISTRY

Outline how the main pollutants are formed in vehicle engines and the environmental problems they cause. Explain why different types of vehicle engine produce different exhaust emissions.

[9]

1	**How pollutants are formed**		**pg**
a	NO_x formed when nitrogen and oxygen in air react at high temperatures;	1	7/3
b	CO comes from incomplete combustion and HC is unburnt fuel;	1	7
c	Complete combustion of fuel gives carbon dioxide and water	1	—

2	**Further reactions**		
a	NO_x reacts with HC to produce photochemical oxidants such as peroxyacetyl nitrate (PAN)/ozone; owtte	1	3
b	Ozone formed from photochemical reaction of NO_x and O_2 **and** concentration builds up;	1	4
c	Extra NO_2 makes ozone formation faster **and** disrupts steady state;	1	4

Give a detailed account of the reaction mechanisms involved in the production of acid rain from atmospheric nitrogen.

[4]

3	**Production of NO**		**pg**
a	at high temperature (homolytic fission of) O_2 molecule produces (two) oxygen atoms / free radicals; **statement**	1	3
b	oxygen atom / free radical reacts (with nitrogen) to form nitrogen monoxide, which oxidises to form nitrogen dioxide; **statement**	1	3

4	**Acid rain**		**pg**
a	nitrogen dioxide reacts with OH radical to form nitric acid;	1	4

5	**Reaction mechanism**		**pg**
a	Identifies initiation and propagation stages;	1	—

Describe how heterogeneous catalysts are used to reduce levels of air pollution from vehicles. Your answer should include….

- **an explanation of how heterogeneous catalysts work.**
- **a discussion of how titanium dioxide crystals on Noxer blocks catalyse oxidation reactions that remove NO_x from the atmosphere.**
- **the way in which Three Way Catalytic converters are designed to give optimum conversion of pollutants.**

[10]

6	**Action of heterogeneous catalysts**		**pg**
a	Heterogeneous catalysts are in a different phase to the reactants/involve adsorption and desorption;	1	CI
b	Reactant adsorbed onto surface; bonds are weakened and break; clear statement	1	CI
c	New bonds form, bonds with catalyst are weakened / break or molecules diffuse away; owtte;	1	CI
d	CO and HC oxidised by catalyst **and** NOx reduced	1	CI

7	**Removal of NO_x by NOXER blocks**		**pg**
a	TiO_2 absorbs (UV) light, electrons are excited; (statement);	1	5
b	Water splits to give a hydroxyl radical and an electron that is given back to the TiO_2; allow annotated eqn.	1	5
c	Both the hydroxyl radical and the superoxide ion form nitrate ions from nitrogen oxides (statement).	1	5
d	The nitrate washes into the concrete to form stable compounds;	1	5
e	NOXER reactions are faster because energy is absorbed by the coating; reactants are held together; titanium oxide is a better oxidiser; (any 2 points)	1	5

8	**Extra chemistry (2 max.)**
	Pollutants that come directly from the engine are PRIMARY pollutants;
	discussion of free radical as species with an unpaired electron
	definition of initiation and/or propagation reactions;
	homolytic fission – one electron goes to each atom
	shows changes in oxidation states of N in reactions
	nitrates are very soluble and so are washed away by rain.
	catalysts work by lowering activation energy/ providing a different reaction pathway

EVALUATION

Outline how the main pollutants are formed in vehicle engines and the environmental problems they cause. Explain why different types of vehicle engine produce different exhaust emissions.

[9]

9	**Environmental problems**		
a	Any 2 points about primary pollutants from: NO_x absorbs IR/causes climate change; CO is toxic/inhibits oxygen transport in blood; SO_x causes respiratory difficulties / acid rain; CO_2 causes climate change;	1	3/4
b	Photochemical smogs cause eye irritations/respiratory difficulties;	1	3

10	**Different engine types**		pg
a	Engine types differ because fuel:air ratio is different;	1	7
b	conventional engine produces high levels of NO_x due to high internal temperatures AND lean burn engine is cooler so produces less NO_x;	1	7
c	lean burn produces more HC because after fuel is burnt, concentration is too low to support combustion;	1	7
d	Under lean conditions, HCs and CO are removed / oxidised (by the catalyst) - there is less conversion of NO_x; OWTTE	1	9
e	Under rich conditions NO_x is converted (by the catalyst) but there is not enough oxygen to remove CO or HC; OWTTE	1	9

Describe how heterogeneous catalysts are used to reduce levels of air pollution from vehicles. Your answer should include….

- **an explanation of how heterogeneous catalysts work.**
- **a discussion of how titanium dioxide crystals on Noxer blocks catalyse oxidation reactions that remove NO_x from the atmosphere.**
- **the way in which Three Way Catalytic converters are designed to give optimum conversion of pollutants.**

[10]

11	**Catalytic converters**		**pg**

a	Platinum group metals are used with two examples from: active at (relatively) low temps / good thermal stability / poison resistant / long performance (50 000 miles);	1	8
b	honeycomb structure or small crystals gives large surface area;	1	8
c	Mixture of metals and oxides provide oxygen storage capacity;	1	8
d	Stoichiometric mixtures give optimum conversion of pollutants.	1	8
e	Ceria, CeO_2, stores oxygen in lean conditions and releases it in rich;	1	9

Identify the problems that scientists still need to solve in reducing harmful vehicle emissions. [3]

12 Future work			**pg**
a	(In petrol engines) catalysts need to work when engine starts; plus example of possible future strategy: using catalysts that operate at lower temps / pre-heating the catalyst / trapping HC in molecular sieve / recirculating exhaust gas;	1	9
b	(In diesel engines) Carbon or particulates clog filters **and** combustion damages filter / filter difficult to regenerate;	1	9
c	Need to develop method of regenerating C filters: **and** e.g. using NO_2;	1	9
d	Could develop catalyst-based filter that works at low temperatures for diesel engines;	1	9
e	Removal of NO_x problems possible injection of fuel or ammonia;	1	9

13	Extra evaluation **(2 max.)**
	Diesel are cleanest for gas emissions but produce high levels of smoke / particulates.
	discussion of problems caused by oxidation of S to SO_3 and its removal under reducing conditions (reactions 4 and 5) [may be seen in bullet point 1]
	in diesel engines catalyst oxidises NO to NO_2 to clear filter
	catalyst - ceramic material with an alumina coating absorbs lead;
	oxygen sensors are used to give fuel control feedback to maintain fuel:air ratio;
	no catalyst system removes CO_2 which is major greenhouse gas;

Research skill in using and acknowledging sources of information

R1 **List of sources** used which should include the articles in the question paper and at least two additional and *relevant* references
1 for inclusion of Open Book paper articles (minimum: article 1 + article 2)
1 for TWO other sources, i.e. either or both Salters books + one other, OR two other sources,
1 for specification of at least one non-Open Book source by page numbers,section titles, site titles, encyclopaedia sections, search engine criteria

[3 marks]

R2 **Appropriate material** selected from the question paper and elsewhere to produce a report within the required word limit

[1 mark]

Examples of reasons why this mark may not be awarded include.

- **exceeding the word count** (see below)
- not declaring a **page word count** if you suspect the word count is over
- many sources quoted, with no evidence that they have been used
- excessive **irrelevant material** (use wavy line in left hand margin)
- inclusion of large amounts of material in **appendices**
- mis-use of sources e.g. repeated **errors** in material selected.

Guidance on word count	
< 1050 words	OK
> 1050 < 1100	Lose 1 mark (**R2**)
>1100	Draw line at about 1000. Do not mark past this point Lose 2 marks (**R2** and **C1b**)
Words on diagrams/in equations do not count but **excessive use of lengthy text boxes inserted into diagrams should be penalised.**	

R3 **Text annotation**
Text annotated where appropriate to acknowledge use of information from the sources listed
(1 mark for 2 or more relevant annotations)

[1 mark]

Examiner annotation: Underline candidate's annotation and write 'A' in the left hand margin for the first two sources seen.

[Total: 5 marks]

Quality of Written Communication

S **Summary** Four relevant **CHEMICAL** points which summarise the content of the candidate's own response.

[4 marks]

Ideas to look for…

- **chemical reaction given in words**
- **description of process e.g. how heterogenous catalyst works/ free radical reactions**
- **conditions for particular reactions e.g. high temperatures**
- **definition of chemical terms e.g. catalyst, heterogeneous**
- **feature of a reaction e.g. molecules split homolytically**

Main Report

C1 Structure of report

a *Well-structured report with **relevant information** organised **clearly** and coherently **without undue repetition**.*

[1 mark]

Examples of reasons why this mark may not be awarded.

- **jumbled order** or difficult to follow report.
- **undue repetition** (***annotate*** 'R' in left hand margin)
- a report where presentation and organisation of the information is weak enough to make the report difficult to follow.

b **Balanced coverage** of the required points.

[1 mark]

Examples of reasons why this mark may not be awarded.

- exceeding the **word count** (see R2) insufficient balance in the coverage of the **bullet points** on the question paper (use the pattern of marks on the grid as a rough guide).

C2 Clear and correct use of language

a Legible text, appropriate form and style of writing, grammar, punctuation and spelling accurate so that the meaning is clear.

[2 marks]

2 **spelling or grammatical errors** lose 1 mark, 4 errors lose both marks.
***Examiner annotation*:** by underlining error and writing 'S' or 'G' in left hand margin.

Examples of reasons why marks may not be awarded.

- Report not written in **continuous prose** e.g. note form or no use of paragraphs.
- Text or language is illegible or **difficult to follow**.

b Correct use of **scientific and technical** terms.

[2 marks]

2 **scientific or technical term** errors lose 1 mark, 4 errors lose both marks.

Examiner annotation: by underling error and writing 'T' in the left hand margin.
Examples of errors.

- Misuse/omission of **subscripts** or **superscripts** from formulae.
- Gaps in word processed text e.g. omission of '→' from equations.
- **Incorrect terms** used e.g. absorption for adsorption.

Note: If the report contains no or **very few scientific terms**, diagrams or equations, one or both marks should be deducted due to insufficient evidence being available to award.

C3 Good use of equations and structural formulae

[2 marks]

2 marks for 8 relevant and correct of equations or structural formulae;
1 mark for 4 relevant and correct equations or structural formula

Notes:

- **For** minor errors **e.g. missing subscripts, deduct technical language marks as shown in C2b but allow the equation to count towards marking point C3.**

List of possible equations and structural formulae

production of NO_2 from O_2 and N_2 (four equations)
production of acid rain from NO (three equations)
structure of PAN
steps 1 and 2 for production of ozone
steady state of ozone production / removal
production of hydroxyl radical and superoxide ion
production of nitrate ion on Noxer block from NO_2 and/or NO
desirable reactions in petrol engine
conversion of SO_2 to H_2S

C4 Good use of appropriate illustrations (pictures, diagrams, tables, flow charts, graphs, etc.)

[2 marks]

2 marks for 4 relevant illustrations, well-positioned and labelled or well-linked into text; these may be from the articles in the question paper; **1 mark for 2 such diagrams**;

- ***Annotate*** script by writing 'D' ('Diagram') in the left hand margin.

Notes: Illustrations should be **correctly placed** so that they support the flow of the text. One or both marks can be lost if the illustrations are incorrectly placed.

List of possible illustrations

diagram of pollutants being released into atmosphere
structure of titanium dioxide
function of NOXER blocks
mechanism of heterogeneous catalyst
energy profile diagram for catalyst
percentage gas conversion by catalyst / gas exhaust emission graph or chart
continuously regenerating trap
honeycomb structure of catalyst
diagram of car with oxygen sensor

[Max. 10 marks]

Blank marking grid

			Script			
	Script	**:-**				
1	How pollutants form	a b c				**1**
2	Further reactions	a b c				**2**
3	Production of NO	a b				**3**
4	Acid Rain	a				**4**
5	Reaction mechanism	a				**5**
6	Heterogeneous catalysts	a b c d				**6**
7	Noxer blocks	a b c d e				**7**
8	Additional chem points [MAX 2]	8_1 8_2				**8**
	Chemistry	**Max 14**				

9	Environmental problems	a b				**9**
10	Engine types	a b c d e				**10**
11	Catalytic converters	a b c d e				**11**
12	Future work	a b c d e				**12**
13	Additional Eval points [MAX 2]	13_1 13_2				**13**
	Evaluation	**Max 12**				

		:-				
	R1 sources	1 + 1 + 1				**1**
	R2 appropriate material	1				**2**
	R3 annotation	1				**3**
	R total	max 5				**4**
	Summary	max 4				**5**
	C1 stucture	1 + 1				**6**
	C2 spag and technical	2 + 2				**7**
	C3 formulae and equations	2				**8**
	C4 illustrations	2				
	C total	Max. 10				
	Final Total	**Max 14**				

Mark Scheme 2854
June 2007

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

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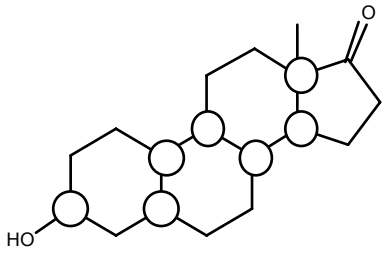
Mark Scheme	Unit Code 2854	Session June	Year 2007	Version Final

Question	Expected answers	Marks
1 (a)	26	1
1 (b)	(secondary) alcohol (*primary, tertiary are CON)* (1); *ignore cyclopentanol* phenol (1) *Mark separately.*	2
1 (c)	Two correct statements from: (*ignore incorrect statements)* delocalised; spread out over/shared between all <u>carbon</u> atoms/ the ring. *Ignore "spread over whole molecule"* ; not associated with bonds/ <u>pairs</u> of atoms; *ora for saturated ring* form a ring (implied) above and below plane of C atoms (AW)	2
1 (d) (i)	(cyclo) alkene/ <u>carbon-carbon</u> double bond *ignore C=C except to qualify "double bond"*	1
1 (d) (ii)	bromine (1); decolorised (*NOT discoloured*)/ brown/orange/yellow/red to colourless (1) *NOT clear*	2
1 (e)	Both have C–H at 2850–2950 C=O/ ketone at 1705 – 1725 (cm^{-1}); O–H/ alcohol/phenol/hydroxy(l) at 3200–3600/ 3600–3640 (cm^{-1}); C–O at 1050–1300 (cm^{-1}) TWO of these, bond(1); absorption range (1) Nandrolone differs by C–H at 3000–3100 (cm^{-1}); C=C/ alkene at 1620–1680 (cm^{-1}); ONE of these, bond(1); absorption range (1) *if no mention of nandrolone, max 1* *do not award a mark for the following but allow ecf after first occurrence:* • *correct name rather than bond* • *value within range rather than range* • *wrong units*	6
1 (f)	Acidified potassium (di)chromate (1) *or correct formulae* *IGNORE acid type and incorrect formulae* Heat/reflux (1) *allow only if dichromate mentioned (even if as a slightly wrong formula)*	2
1 (g) (i)	 any two *accept more if correct, otherwise CON*	1
1 (g) (ii)	Four different groups around/ attached to (a carbon) (1)	1
1 (g) (iii)	Isomers are object and mirror image/ mirror images/ reflections (1)	1

1 (h) (i)	M_r = 276 (1); 2.2×10^{-9} x 276 (*ecf on* M_r) (= 6.1×10^{-7}) (1) /1000 and evaluate = $6.1(6.07) \times 10^{-10}$ (1) *ecf* $6.1(6.07) \times 10^{-4}$ scores (2)	3
1 (h) (ii)	high-boiling (AW) liquid (1) on (finely divided, inert) solid support (1) *allow "tube" for second mark if first mark scored* unreactive gas/inert gas/nitrogen (1)	3
1 (h) (iii)	M_r/RMM/(relative)molecular mass/ mass of molecule/mass of parent ion/ fragments (1)	1
	Total	**26**

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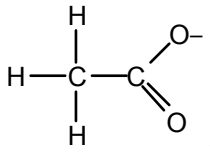
Question	Expected answers	Marks
2 (a)	 *allow delocalised structure*	1
2 (b)	copper sulphate/nitrate *allow chloride* (1) sodium/potassium/lithium hydroxide (1) allow correct formulae	2
2 (c)	**2.1** precipitation **2.2** acid-base	2
2 (d)	(verdigris) is not affected by sunlight/uv/oxygen/air/water/CO_2/ resists oxidation/ is stable/ will not decompose	1
2 (e)	*Any correct four from the following. Ignore incorrect (or CON) statements* Indication that d energy levels are involved; excitation of electrons; absorbs in visible (AW) / absorbs colour; *E = hv*; complementary colour/ light not absorbed transmitted/reflected (NOT emitted); *subsequent references to emission CON to this mark* *and:* ligands affect energy difference/ splitting (1) *not just "affect colour/ frequency"* *Allow all marks as labels on the diagram,*	5
2 (f)	rises to peak somewhere below 600(1); falls under word "red" (1) *can fall to zero*	2
2 (g)(i)	Atomic emission spectrum will contain lines (1); Lines/ spectrum characteristic of each element (AW) (1)	2
2 (g) (ii)	Electrons dropping energy-levels (1); Energy-levels/ gaps between levels differ for different elements (1)	2
	Total	**17**

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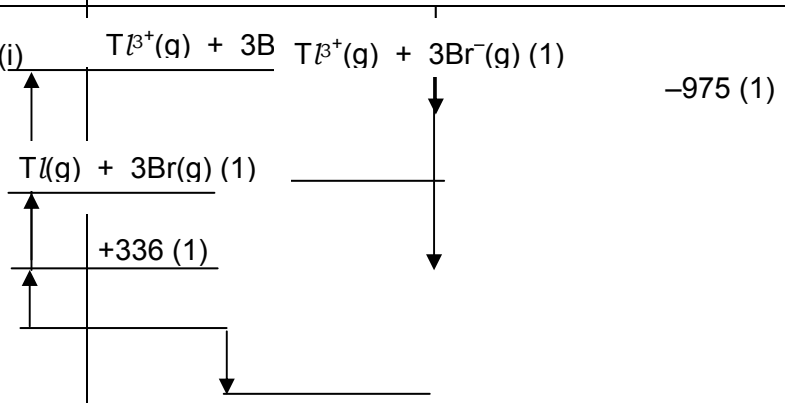
Question	Expected answers	Marks
3 (a)	(glass) is opaque to/ absorbs infrared (AW)	1
3 (b) (i)	$6s^26p^1$ (1) for 6 (1) for s^2p^1 *ignore* $5d^{10}$ *– anything else is CON to second mark*	2
3 (b) (ii)	*Two from:* • Tl in Group 3/ same group as Al /has three electrons in outer shell; • Forms 3+ ions/ oxidation state +3/(three) electrons easily lost/ low IE/ Al reacts with halogens to form AlX_3 (AW)/ forms three covalent bonds; • (loss of 3 electrons or formation of 3+ ion forms) stable ion/ stable/ noble gas (electron) configuration *ignore references to bromine*	2
3 (c) (i)	 *no ecf on enthalpy changes* *ecf on number 3 (eg 3Br)* *ecf on species (with state symbols) that are subsequently repeated* *misprinted scripts (+5433) – allow 1 and 4 ±5; report to TL*	5
3 (c) (ii)	ionisation enthalpies/energies (*or singular)* (of Tl) (1); sum of first three of these (*depends on first being correct*) (1)	2
3 (c) (iii)	(Enthalpy change of) formation/–177/–190 (1) *allow symbols* *(e.g.* ΔH_f*)throughout*	1
3 (d)	42 moles Br = 3360g. 58 moles I = 7366g. (1) Ratio = 7366/3360 = 2.2 g (1) *allow ecf from calculation with one error*	2
3 (e) (i)	large size (1) small/single charge (1) low charge density scores (2) *ignore electron density*	2
3 (e) (ii)	lattice enthalpy/energy (1) hydration/solvation energies/enthalpies (*or singular*) (1); sum of values for the ions(1)	3
3 (e) (iii)	(enthalpy change of) solution (1) +325 (1) *must have positive sign*	2

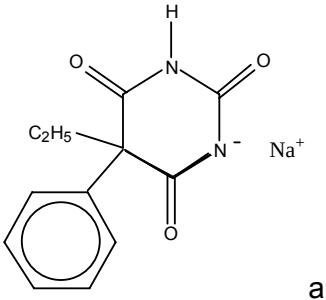
3 (f)	(fairly/ quite) high melting/ solid at room temperature/ brittle (1); strong forces between ions (1); conduct when molten (1); ions can move/ ions are free/ ions carry charge (1); *ignore references to solution, boiling point or crystallinity* SPAG QWC (*assess the whole piece; must be more than one sentence; bullet points are acceptable if written as sentences; sentences must start with capital letter; ignore commas; one SPAG error allowed – repeated mis-spellings of the same word count as one error).*	4 1
	Total	**27**

Mark Scheme	Unit Code 2854	Session June	Year 2007	Version Final

Question	Expected answers	Marks
4 (a)	+5 (1); +3 (1) *(1) max for signs after numbers NO Roman numerals unless they have signs*	2
4 (b) (i)	equilibrium/ incomplete dissociation/ionisation	1
4 (b) (ii)	$[H^+]\ [NO_2^-]/[HNO_2]$ (1)	1
4 (b) (iii)	$[H^+] = \sqrt{(K_a \times M)} = 6.86/6.9 \times 10^{-3}$ (1) *stated or implied* pH = – log $[H^+]$ = 2.16/2.2 (1) *allow ecf on second mark if incorrectly calculated value of $[H^+]$ can be seen*	2
4 (b) (iv)	$[H^+] = [NO_2^-]$ / all H^+ comes from acid/ no H^+ comes from water / $[HNO_2]_{eqm} = [HNO_2]_{init}$ (AW)	1
4 (c) (i)	+ $H_2O(l)$ *ignore state symbol*	1
4 (c) (ii)	(NO) is oxidised/(NO) is converted (AW) to NO_2 (1); by oxygen/O_2 (in air) (1) "NO reacts with oxygen (AW)" scores both marks	2
4 (d) (i)	the air (ALLOW atmosphere)	1
4 (d) (ii)	increase rate/ speed up the reaction/setting up of equilibrium (AW) (1) more frequent collisions/ more likely to collide/ collide more often/ greater chance of collision.... all between <u>molecules/particles</u> (1) more particles in the same volume (AW) *NOT area/* particles closer (1) moves equilbrium* (position) to right/ increases yield of ammonia (1) fewer molecules on right (1) (equilibrium* move) reduces pressure/ opposes the change (1) *must be mentioned once 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) rate (of reaction); collisions/ collide (etc.); molecules/ particles; equilibrium; yield	6 2
4(d) (iii)	*Operating costs*: e.g. maintaining/ achieving high pressure/ thick pipes (AW) *or Safety issues* e.g. danger of explosions (1) *or* "Yield does not increase much" (AW)	1
4 (e) (i)	$p NH_3^2/p N_2 \times p H_2^3$ (2) ALLOW square brackets with "p". all correct except for ONE of the following, scores (1) • hydrogen not cubed and/or ammonia not squared • concentrations shown • wrong way up NO CREDIT if + signs Units atm^{-2} *(allow ecf unless + signs used)* (1)	3

4 (e) (ii)	$pNH_3 = \sqrt{(K_p\ pN_2\ pH_2^3)}$ (1) stated or implied pNH_3 = 28.8 atm (1); 3 sf - *if answer incorrect, mark separately provided there is some working* (1) *ALLOW ecf from wrong expression in 4(e)(i) or first marking point*	3
	Total	**26**

Mark Scheme	Unit Code 2854	Session June	Year 2007	Version Final

Question	Expected answers	Marks
5 (a) (i)	amide *ignore peptide*	1
5 (a) (ii)	C_2H_5 group (*stated or implied*)(1); CH_3 1.0 and CH_2 1.4 (1); Ratio 3:2 (1)	3
5 (b) (i)	one water molecule correctly hydrogen-bonded to O and one water molecule correctly hydrogen bonded to the H or N of N–H (1); *CON if there is also an inappropriately hydrogen bonded water molecule* *For any ONE water molecule hydrogen bonded to O AND ONE hydrogen bonded to N-H (but not necessarily the same ones each time)* polarity shown on both sides of each hydrogen bond (1); lone pairs shown pointing down hydrogen bond(1); straight bonds O-H-O and N-H-O (1)	4
5 (b) (ii)	benzene (ring)/ arene/ phenyl (1) *IGNORE references to alkyl groups*	1
5 (c)	 anion (1); *Ignore H_2O etc* Na^+ (*mark separately, unless N^- – Na^+ which does not score this mark)* (1)	2
5 (d) (i)	No/little/resists change in pH (1); when <u>small</u> amounts (1) of <u>acid and/or alkali/base</u> are added (1) weak acid and its salt/ conjugate base *(or equivalent for weak base)* (1)	4
5 (d) (ii)	pH = –log/lg/$\log_{10}[H^+(aq)]$ (1) 3.98/4 x 10^{-8} (1)	2
5 (d) (iii)	3.9/3.98 = 0.975/0.98/1/1.0 (:1) *ecf*	1
5 (e)	*Four from:* **A** unionised dissolves in fat/ can pass through fat **B** weak imf/ weak bonds/ id or pd/ between fat and unionised **C** fat is non-polar/ pd or id bonds in fat **D** ion(ised) insoluble/less soluble in fat/ more soluble in blood/water/ stays in blood/water **E** strong imf/ strong bonds/ ion-dipole/ hydration/ between ion(ised) and water **F** imf/bonds broken if ion(ised) dissolves in fat	4

5 (f)	[salt]/[acid] = $3.3 \times 10^{-4}/3.98 \times 10^{-8} = (8.3 \times 10^{3})$ (1); *ecf from any wrong expression in (d)(iii)* *ALLOW K_a ratio (8.46×10^{3}) IF second mark scored.* (much) more salt than acid / there are more ions/ more ionised (than phenobarbitol) (1); *mark separately*	2
	Total	**24**

Advanced GCE [Chemistry (Salters)] (3887/7887)
June 2007 Assessment Series

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u
2848	Raw	90	65	57	49	42	35	0
	UMS	120	96	84	72	60	48	0
2849	Raw	90	66	59	52	45	38	0
	UMS	90	72	63	54	45	36	0
2850	Raw	75	55	48	42	36	30	0
	UMS	90	72	63	54	45	36	0
2852A	Raw	90	73	67	61	55	49	0
	UMS	90	72	63	54	45	36	0
2852B	Raw	90	73	67	61	55	49	0
	UMS	90	72	63	54	45	36	0
2854	Raw	120	89	80	71	62	53	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	20.3	40.6	59.0	75.0	87.6	100	9828
7887	28.8	52.4	72.7	87.0	96.5	100	6755

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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