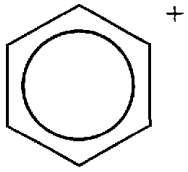
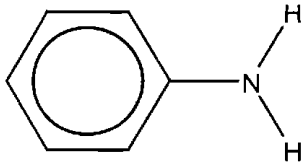
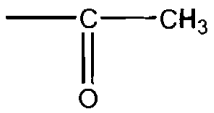
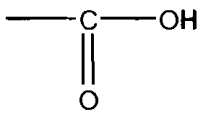
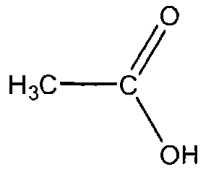
Mark Scheme	Unit Code 2849	Session June	Year 2005	FINAL

Question	Expected answers	Marks
1 (a) (i)	(Secondary) amide (1).	1
1 (a) (ii)	Ethanoyl chloride (CH_3COCl) / ethanoic anhydride ($(CH_3CO)_2O$) (1).	1
1 (b) (i)	93 (1).	1
1 (b) (ii)	16 (1) *ecf for 92 then 15.*	1
1 (b) (iii)	NH_2 (1) *ecf* CH_3.	1
1 (b) (iv)	$C_6H_5^+$ *allow*  *Correct structure/molecular formula for phenyl group (1);* *positive charge on structural formula (1).*	2
1 (b) (v)	 *NH_2 group on molecule (1);* *phenyl group (1).*	2
1 (b) (vi)	Amino group (NH_2) reacts with/accepts H^+ ions/protons (1); Resulting ion attracts water molecules/salt formed is soluble / ion formed can interact with other species in solution (1).	2

1 (c) — 3

chemical shift	type of proton
2.1	
11.4	

1 mark each for type of proton (2);



(1).

1 (d) — 6

One mark each for points in bold *and then any* ***three*** *others up to a total of 6 marks:*

Pencil line near bottom;
of plate;
dissolve acetanilide in ethanol;
spot sample of mixture on line;
solvent in beaker below sample *not ethanol*;
cover beaker (with lid/film);
leave until solvent front nears top of plate;
remove and dry plate;
(UV light or iodine) to locate *(use of locating agent)*;
use of a standard compound to identify acetanilide/ R_f values the same / spots the same height.

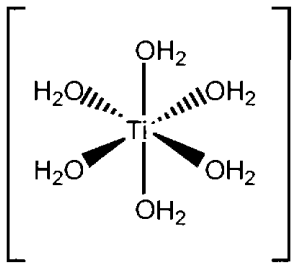
QWC — 1
Award the mark if there is only one error in spelling, punctuation or grammar in **any two relevant sentences**.

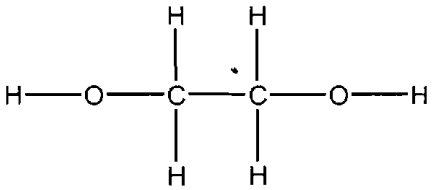
1 (e) — 2

2 marking points from

Synthesis (1);
modification of structure/change properties *e.g. solubility* /make more effective *e.g. increase time when effective* (1);
analysis/identification(1)
checking purity (1)
scaling-up processes (1)
formulation of preparation *e.g. tablets, solution, spray etc.* (1).
Do NOT allow testing alone or testing for safety etc. or on animals.

Total mark — **23**

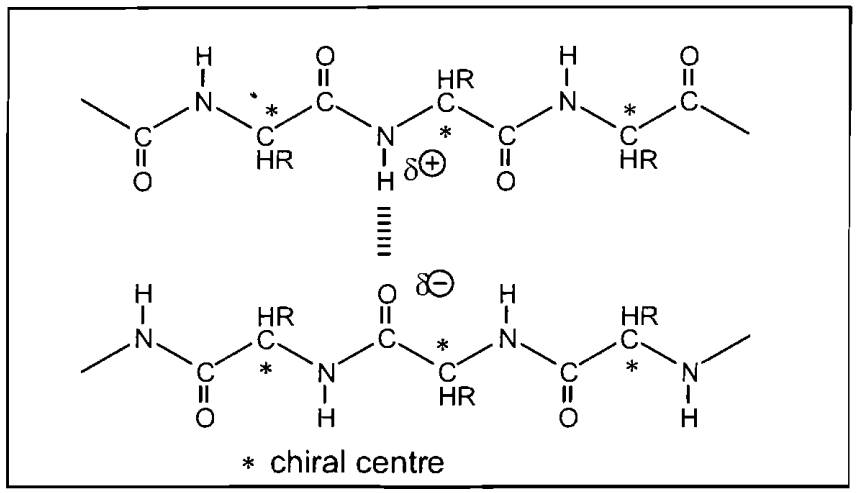
Question	Expected answers	Marks
2 (a)	Disrupts lattice/lattice less ordered AW (1). *Accept that layers in structure are no longer able to slide over one another as easily.*	1
2 (b) (i)	*Any **two** of the following **four** marking points:* Absorb light/in visible region (1); 3d energy shell/ energy levels split into 2 groups AW (1); electrons move up/promoted/excited to higher (energy) level (1); transmits (*or* reflects) the complementary colour/light not absorbed (1).	2
2 (b) (ii)	 6 water molecules around Ti in correct shape and charge correct (1); O shown bonded to Ti (1); octahedral shape (1).	3
2 (b) (iii)	Two different arrangements/isomers of ligands around central ion (1); show structures of the *cis* and *trans* isomers using diagrams/ describe the two isomers *e.g. chlorines may be adjacent or opposite or describe cis-trans isomers* (1).	2
2 (c) (i)	Mol dm^{-3} (1).	1
2 (c) (ii)	$1.300 \times 10^{-4} = [H^+(aq)]^2 / 0.010$ (1); $[H^+(aq)] = (1.3 \times 10^{-6})^{1/2}$ (1); $= 1.14 \times 10^{-3}$ *1 mark for answer if sig figs are correct .*	3
	Total mark	**12**

Question	Expected answers	Marks
3(a)	Full detail needed for 2 marks  (2) Two –OH groups on C chain (1); correct C chain (1).	2
3 (b) (i)	1,6-diaminohexane (2); aminohexane/hexyldiamine (1); 1,6-di (1).	2
3 (b) (ii)	The two molecules add/react/join together and eliminate (1); a molecule of water (1).	2
3 (c)	**One mark for the point in bold** and then any **one** other: **Nylons have hydrogen bonding between the chains/nylons can hydrogen bond to polyester chains** (1); hydrogen bonding is much stronger than (permanent dipole-permanent dipole) forces between polyester chains AW (1); greater energy/force will be needed to separate polymer chains in nylons (1).	2
3 (d) (i)	*Burning:* no solid waste (which is expensive to dispose of) / no landfill needed / energy recycled (1); *burying:* no environmental issues with gas emissions from burning AW /non-biodegradable therefore no threat to environment AW (1).	2
3 (d) (ii)	(Heat under) reflux (1); (moderately concentrated) hydrochloric acid or sodium hydroxide *(accept sulphuric acid)* (1).	2
3 (d) (iii)	$BrO_3^-(aq) + 6H^+(aq) + 5Br^-(aq) \rightarrow 3Br_2(aq) + 3H_2O(l)$ correct chemical species (1); balanced may be x2 (1). *Ignore state symbols.*	2
3 (e)	*Any **four** of the following five marking points:* Dilute bromine solution to make a range of concentrations (1); select suitable filter for colorimeter (1); zero colorimeter with water (1); measure absorbance/transmittance of each bromine sample (1); plot absorbance/transmittance against concentration (1).	4

<table>
<tr><th>Question</th><th>Expected answers</th><th>Marks</th></tr>
<tr><td>3 (f) (i)</td><td>
<table>
<tr><td>reactant</td><td>order</td></tr>
<tr><td>bromide ion, Br^-</td><td>1</td></tr>
<tr><td>bromate ion, BrO_3^-</td><td>1</td></tr>
<tr><td>acid, H^+</td><td>2</td></tr>
</table>
1 mark for each order correct (3).
</td><td>3</td></tr>
<tr><td>3 (f) (ii)</td><td>Rate = k x $[Br^-(aq)]$ x $[BrO_3^-(aq)]$ x $[H^+(aq)]^2$ (1) ignore state symbols and note any ecf from f(i).

$mol^{-3}\ dm^9\ s^{-1}$ ecf (1).</td><td>2</td></tr>
<tr><td></td><td>Total mark</td><td>23</td></tr>
</table>

Question	Expected answers	Marks
4 (a) (i)	1.56 V (1) *ignore any sign.*	1
4 (a) (ii)	Non-standard conditions / not 1 mol dm^{-3} concentrations of correct ions / not 25 °C/incorrect ions in solution (1)	1
4 (a) (iii)	Zinc forms/goes into solution as zinc ions / Zn/Zn^{2+} has more negative electrode potential ora (1); electrons flow from zinc (into the wire)/Zn loses electrons (1).	2
4 (b)	(High resistance) voltmeter (*connected to metal electrodes*) (1); salt bridge (*dipping in both solutions*) (1); correct metal in solutions of correct ions (*in both half-cells*) (1); concentrations 1.0 mol dm^{-3} (1); temperature 25 °C/298 K (1).	5
4 (c)	$H_2 \rightarrow 2H^+ + 2e^-$ balanced equation, even if reverse direction (1); correct direction (1); $H \rightarrow H^+ + e^-$ 1 mark only.	2
4 (d)	$3s^2\ 3p^6\ 3d^{10}\ 4s^2$ (2); 20 electrons added (1); correct arrangement of orbitals, *allow if 3d written after 4s* (1). 3rd ionisation energy of Zn too high/too much energy needed to remove an electron from/break into 3rd shell AW (1)	3
	Total mark	**14**

Question	Expected answers	Marks
5 (a) (i)	 * chiral centre Bond correct (1) partial charges correct (1).	2
5 (a) (ii)	Mark any one chiral atom correct (*see above*) no mark awarded if a wrong atom is also marked (1); C atom is asymmetrical/bonded to four different atoms/groups (1).	2
5 (a) (iii)	(α-)helix (1); (β-) pleated/sheet (1).	2
5 (b)	*Any **two** marking points from the following:* Covalent/disulphide bridges/bonds (1); ionic (1); instantaneous dipole–induced dipole forces (1); permanent dipole–permanent dipole forces / permanent dipole–induced dipole forces (1).	2
5 (c) (i) 5 (c) (ii)	***One mark each for points in bold** and then any **three** others up to a total of 5 marks for both parts:* *Allow cross marking of points.* **c(i)** **Enzyme used to cut required gene** (1); from DNA of organism (1); plasmids/rings of DNA extracted from bacterial cells (1); enzyme used to cut plasmids (1); **c(ii)** **new gene spliced in using other enzymes** (1); modified plasmids replaced in bacterial cells (1); cells multiply in fermenter/ cultured (1); new gene causes synthesis of the required protein (1).	5
5 (d) (i)	Moderately concentrated acid/ HCl(aq) (1). *Do not allow dilute acid or sulphuric acid.*	1
5 (d) (ii)	Reaction mixture is boiled and vapours are cooled AW (EVAP & COND mark) (1) sealed top is a CON; liquid is returned to mixture / no loss of reactants or products AW (1).	2
5 (e)	Type of H atoms present AW (1); (relative) numbers of each type (1).	2
	Total mark	**18**