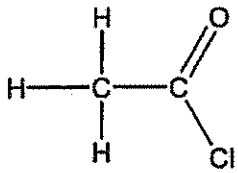
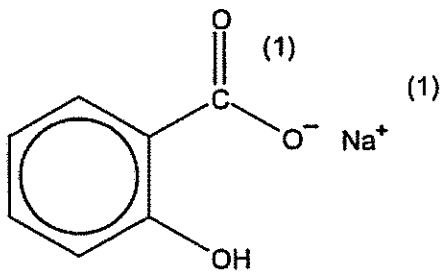
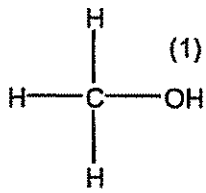
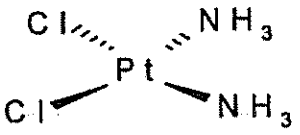
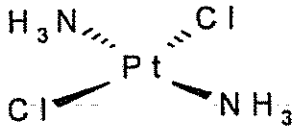
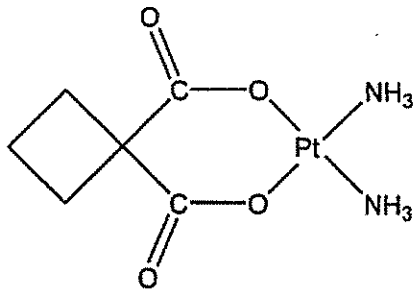
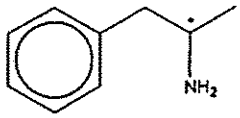
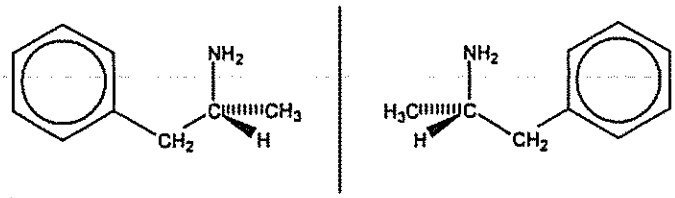
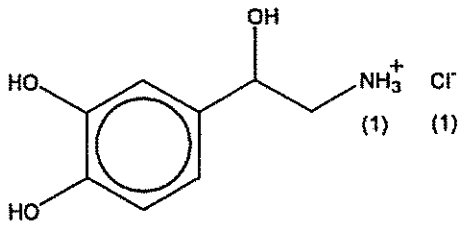
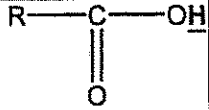
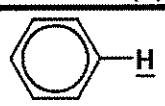
Question	Expected Answers	Marks
1(a)	(Several) amino acids joined together (stated or implied); by an amide link/CONH;	2
1(b)	A :carboxylic acid (accept carboxyl); B :phenol;	2
1(c)	**FULL STRUCTURAL** (1) (1)  second mark is consequential on acyl chloride group allow 1 mark for CH_3COCl	2
1(d)(i)	recrystallisation	1
1(d)(ii)	TLC; 1 spot AW Melting point ; sharp/ cf. with data value Allow 1 mark for glc/ hplc/ nmr/IR/mass spec/titration to find effective M_r	2
1(e)(i)	CH_3OH H_2O Alcohol Other product	2
1(e)(ii)	concentrated sulphuric acid/ concentrated hydrochloric acid	1
1(f)	 (1)  (1) (Full structural formula not necessary) (1) if 2-hydroxybenzoic acid Ignore O^-Na^+ on phenol group	3
		[Total:1

Question	Expected Answers	Marks
2(a)	(central) metal atom/ion; surrounded by/joined to ligand(s)/ a number of (stated or implied) negatively charged ions/ a number of (stated or implied) molecules with lone pairs (of electrons)	2
2(b)(i)	 (1)  (1) accept only diagrams with 90 degree bond angles/ ignore Cl_2 or ambiguous attachments	2
2(b)(ii)	geometric/cis-trans isomerism	1
2(b)(iii)	4	1
2(b)(iv)	tetrahedral	1
2(c)	causes the formation of $Pt(NH_3)_2Cl_2$ / cisplatin(which is neutral); increased/ high/large concentration of chloride ions/ $[Cl^-]$; pushes the equilibrium to the LHS;	3
2(d)(i)	lone pair /non bonding pair (of electrons)	1
2(d)(ii)	4from: DNA consists of two (polynucleotide)chains; in a *double helix*; *each chain/strand/backbone is made of *deoxy ribose*/sugar & *phosphate* groups;(do not accept ribose) *each chain has attached *bases*; *the bases on each chain are linked by *H bonding*; specific bases are *paired* between the two chains ie A-T,C-G; * could be gained from a clearly labelled diagram *Qwc:* *Minimum 2 sentences / bullet points; correct use of at least 2 of the italicised terms.*	4 + 1

2(e)	 1 mark for each correct O bond (the second should give the approximately correct angle between the Pt-O bonds) 1 mark for both ammonias bonded correctly in cis conformation **No ambiguous attachments/ bonds should be shown**	3
2(f)	bidentate ligand (ignore polydentate)	1
		[Total:20]

Question	Expected Answers	Marks
3(a)	There is little or no air/oxygen present.	1
3(b)(i)	$2Fe + O_2 + 2H_2O \rightarrow 2Fe^{2+} + 4OH^-$ (accept $Fe(OH)_2$) equations added together (anticlockwise)(no electrons shown) ; balanced (not equilibrium) (consequential on first mark)	2
3(b)(ii)	(+)0.84V must have units	1
3(b)(iii)	$Fe_2O_3 . x H_2O$; (accept any value of x) / accept $Fe(OH)_3$; further oxidation takes place;	2
3(c)(i)	A: $Fe \longrightarrow Fe^{2+} + 2e$ correct equation chosen ; oxidation ; B: $4e + O_2 + 2H_2O \longrightarrow 4OH^-$ 2 correct half equations wrongly assigned scores 1	3
3(c)(ii)	From A towards the surface in helmet; ecf from (c) (i)	1
3(d)	increases the conductivity of the water/increase flow/number of electrons.	1
3(e)	Magnesium / zinc (1 mark); 3 from choose a metal with a more negative E^θ value (than iron); stronger reducing agent (than iron); the metal (**not** the cation) (stated or implied) supplies electrons; it gets oxidised/reacts/corrodes (in preference)/more reactive; metal can be replaced once it has corroded away;	4
		[Total:15]

Question	Expected Answers	Marks
4(a)	$\frac{6.8 \times 0.10}{1000}$ x5/2 (1 mark) = 1.70×10^{-3} moles (1mark) or calculation by ratios (1 mark) = $1.68 \times 10^{-3} - 1.72 \times 10^{-3}$ moles (1mark) (2/3 sf) (ecf from correct calculation scores 1) (Completely correct answer scores 2)	2
4(b)(i)	correctly plotted data from table (points should be all +/- 1 scale division) (2 marks) 1 incorrect point (1 mark max); curve of best fit through data in the table;	3
4(b)(ii)	Either comment that half lives are almost constant; (at least) 2 half lives correctly shown on graph(1) ; labelled clearly (ie horizontal distance **labelled** in words/$t_{1/2}$) or calculated Or As the concentration halves the rate halves; 2 tangents shown on the graph: rate calculated or method shown;	3
4(c)(i)	rate = k $[H_2O_2]^{(1\ mark)}$ rate and k (1mark) deduct 1 mark for each error	2
4(c)(ii)	$\frac{mol\ dm^{-3}s^{-1}}{mol\ dm^{-3}}$ (1) $=s^{-1}$ (1) Correct answer scores 2 ecf from (c)(i) but not if equilibrium constant shown	2
		[Total:12]

<table>
<tr><th>Question</th><th>Expected Answers</th><th>Marks</th></tr>
<tr><td>5(a)</td><td>  </td><td>1</td></tr>
<tr><td>5(b)</td><td>Ecf from (a)
 
(1) mirror image (1)
correct 3d of chiral carbon representation using wedge - dash - solid line</td><td>2</td></tr>
<tr><td>5(c)(i)</td><td>(1°) amine</td><td>1</td></tr>
<tr><td>5(c)(ii)</td><td> 
(1) (1)
deduct 1 for each substituted OH</td><td>2</td></tr>
<tr><td>5(d)</td><td>
<table>
<tr><th>shift in the region</th><th>type of proton</th><th>relative height</th></tr>
<tr><td>3.7</td><td>-OC<u>H</u>$_3$</td><td>9 (1)</td></tr>
<tr><td>11.0</td><td> 
(1)</td><td>1</td></tr>
<tr><td>7.5</td><td> 
(1)</td><td>2 (1) consequential on correct type of proton at 7.5</td></tr>
</table>
</td><td>4</td></tr>
<tr><td></td><td></td><td>[Total:10]</td></tr>
</table>

Question	Expected Answers	Marks
6(a)	polymer chains are aligned/more crystalline/less amorphous/more closely packed/form a neck; (less branched negates this mark) more opportunities for/greater intermolecular forces between the chains/more points of contact **(must have idea of comparison)**; more difficult for the chains to move past each other; AW	3
6(b)	**FULL STRUCTURAL** 4 carbon atoms in a chain with correct number of hydrogens shown; amine group at each end; (allow 1 mark if correct structure shown but not full structural formula)	2
6(c)(i)	More/stronger intermolecular forces in *Stanyl*; these are hydrogen bonds; There are more of these per unit length/ unit mass/Stanyl has a shorter hydrocarbon chain (between amide links) AW; therefore more energy is required to separate the chains/break the intermolecular forces when it melts;	4
6(c)(ii)	M_r of repeating unit =198; $\frac{32000}{198}$ = 162; Allow 161 -162 ecf from incorrect M_r of repeating unit	2
6(d)	3 from waterproof/insoluble tough/not brittle/bulletproof; hard/scratch resistant; low density(not light); rigid/inelastic/does not stretch; resistant to abrasion/hard wearing/durable; resistant to chemical attack/ does not corrode; can be made into fibres; high melting point	3
6(e)	plasmid (bacterial host) is cut; 3 from:- gene in spider DNA is cut/removed; (silk/spider) gene required (to make peptide chains) are joined to the plasmid; the modified plasmid is inserted into the bacteria; the cells multiply/reproduce; in the fermenter; this uses enzymes;	4 [Total:18]