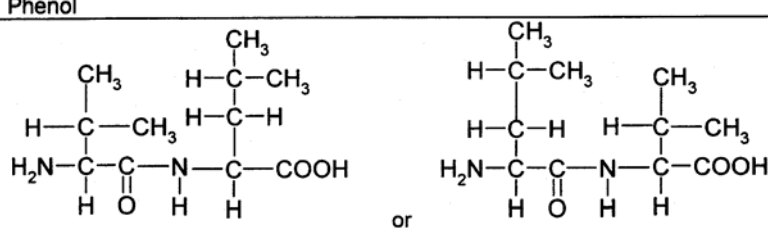
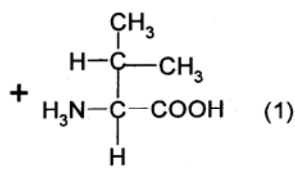
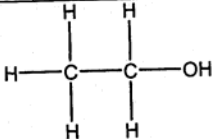
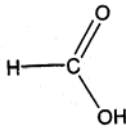
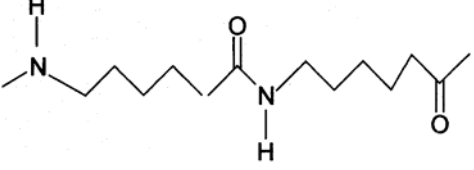


Question	Expected Answers	Marks
1a	2 from: benzene ring; carboxyl/carboxylic acid; amine	2
bi	mirror image	1
bii	optical	1
biii	It has a chiral centre/asymmetric carbon/ carbon attached to four <u>different</u> groups;	1
ci	A. Only molecules of a specific <u>shape</u> work Plus 4 from B. enzyme has an active site; C. with a specific shape; D. because of its tertiary structure/way it folds; E. folding depends on the sequence of amino acids; F. H bonds /electrostatic forces hold (substrate &) enzyme together; G. substrate/reacting molecule fits into enzyme (active site)/ complementary <u>shape</u> /enzyme substrate complex formed; Discussion of denaturing scores 4 max	5
cii	Phenol	1
d	 <p>Only amide link needs to be full structural</p> <p>Amide link(1); Rest;</p>	2
e	 <p>(or NH₃Cl)</p> <p>H⁺ is removed (from solution)</p> <p>Accept: acts like a buffer/ a base/accepts a proton/ COO⁻ reacts with H⁺</p>	2
		15

Question	Expected Answers	Marks
2a	Ethyl methanoate =2 yl and oate =1	2
bi	1.2 = R-CH ₃ (1) 3.6 = O-CH ₂ -R (1) 4.5 =R-OH (1) No R groups 2 max	3
bii	 <p>Product Y (1) ethanol (1)</p>	2
biii	 <p>Product Z (1) methanoic acid (1)</p> <p>NB Allow 2 marks if bii and iii reversed but otherwise completely correct</p>	2
c	<p>M_r ester= 74 (1) Amount of ester= 8.87 /74 (1) = 0.120 mol ecf</p> <p>Multiplication by 1000/500 to give concentration(1) Accept reverse working</p>	3
di	<p>All points plotted correctly 2 marks 1 error = 1mark 2 errors = 0</p> <p>Smooth curve through points 1 mark</p>	3
dii	<p>2 half lives marked correctly on the graph (1); time labelled correctly (1); Allow 1 mark for one half life correctly drawn and labelled</p>	2
diii	Constant <u>half life</u>	1
div	<p>Draw a tangent to the curve; At t=0/ the start; Find gradient owtte</p>	3
e	$\frac{4.60 \times 10^{-5}}{0.240}$ (1)= 1.92×10^{-4} (1) units s ⁻¹ (1)	3
	Total	24

3a i	$\text{H}_2\text{NCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$ Any form of structure correct functional groups(1) ; correct number of carbons between functional groups, (aliphatic should have correct number of H's)(1)	2
a ii	 <p>Correct sequence of groups as shown (1)</p> <p>5 carbon linkages either side (1) ecf from above</p> <p>Allow condensed structure</p>	2
bi	Acyl chloride	1
b ii	Condensation polymerisation; A small molecule (HCl) is eliminated (when monomers join) not water	2
c	more hydrogen bonds in nylon-6,6; strongest / intermolecular forces/hydrogen bonds between <u>functional</u> groups; shorter (hydro)carbon chains in nylon-6,6 (or monomer 2) / more functional groups in nylon-6,6 ORA; carbon chains between functional groups /in both monomers are the same length in nylon-6,6/functional groups line up more regularly ORA; therefore more <u>energy</u> is required to separate the chains/overcome the intermolecular forces when it melts;	4
	Total	11

Question	Expected Answers	Marks
4a	<p>Make up to known volume with water; Add acid (must be sulphuric if named); *Alternative: Make up to a known volume with <u>dilute</u> acid scores 2*</p> <p>Until first <u>permanent pink</u> colour - not with indicator;</p> <p>3 from Filter solution; Wash with water; Dilute stock solution; Pipette sample; Add MnO_4^- from a burette Repeat</p> <p>QWC 2 consecutive sentences grammatically correct with no spelling mistakes.</p>	6 +1
b	$\text{MnO}_4^- + 5\text{Fe}^{2+} + 8\text{H}^+ \rightarrow 5\text{Fe}^{3+} + \text{Mn}^{2+} + 4\text{H}_2\text{O}$ <p>Equation (1); Balancing (not electrons) (1)</p>	2
c	<p>M_r $\text{FeSO}_4 = 152$ (1); Mass of $\text{FeSO}_4 = 106.4\text{g}$ (1); Percentage = $106.4 / 1000 \times 100\%$ (1) = 11% Answer rounded to 2 sf (1)</p> <p>Ecf throughout</p>	4
di	<p>Octahedral shape; Water molecules bonded via oxygen atoms only (no ambiguous attachments)</p>	2
dii	Lone pair/non bonding pair of electrons	1
diii	6	1
ei	(Dirty) green (1); precipitate (1)	2
eii	$\text{Fe}^{2+}(\text{aq}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{Fe}(\text{OH})_2(\text{s})$ <p>Balanced equation (1) State symbols (1) (ignore spectators)</p>	2
eiii	<p>Oxidation has taken place/ reacts with oxygen (precipitate) turns red/brown; Fe^{3+} / (hydrated) iron III oxide / iron III hydroxide formed</p>	3
f	Hexadentate/ polydentate	1
gi	<p><u>Ligand</u> exchange/displacement/substitution Allow nucleophilic substitution</p>	1
gii	$K_{\text{stab}} = \frac{[\text{Fe}(\text{edta})^{2-}]}{[\text{Fe}(\text{H}_2\text{O})_6^{2+}][\text{edta}^{4-}]}$ <p>products /reactants (1) square brackets – charges must be inside concentration brackets(1)</p>	2
	Total	28

Question	Expected Answers	Marks
5ai	$\text{Cd} \rightarrow \text{Cd}^{2+} + 2\text{e}^-$	1
aii	It is less positive/ more negative than the nickel electrode	1
b	<p>Hydrogen electrode dipping into H^+ ions; Strip of cadmium dipping into a solution of cadmium ions; (High resistance) voltmeter/potentiometer in a workable circuit;</p> <p>2 from Salt bridge; Soaked in potassium nitrate/ sodium nitrate ; Standard conditions: 298K/25°C, 1mol dm⁻³, 1 atm not open hydrogen electrode</p>	5
ci	$\text{Fe}^{3+} + \text{e}^- \rightarrow \text{Fe}^{2+}$ 0.77V (1); $\text{Zn}^{2+} + 2\text{e}^- \rightarrow \text{Zn}$ - 0.76V (1) sign with 2 correct values (1)	3
cii	1.53V ecf using sensible answers from c(i)	1
ciii	Zn/Zn^{2+} to $\text{Fe}^{3+}/\text{Fe}^{2+}$ Zinc is the most negative / electrons flow from most negative to most positive Ecf from c(i)	1
	Total	12