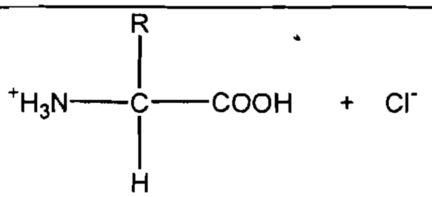
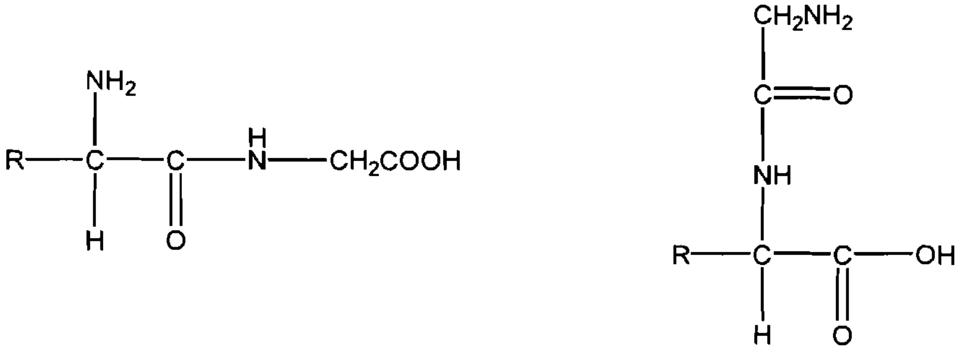
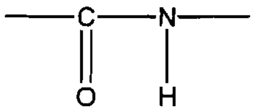
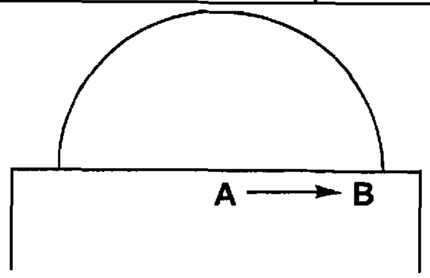
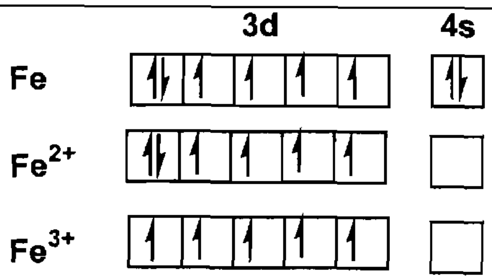
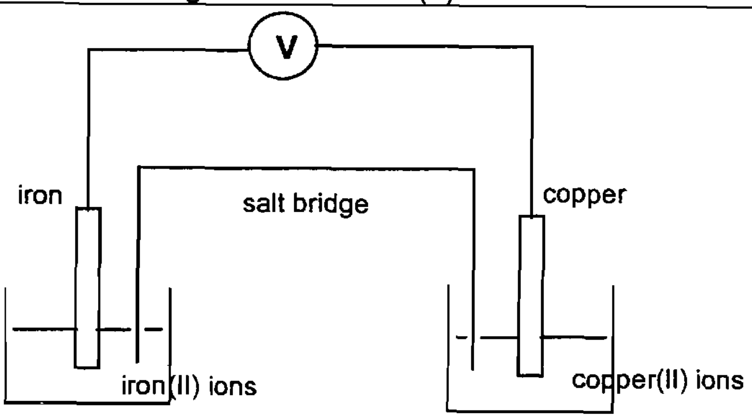
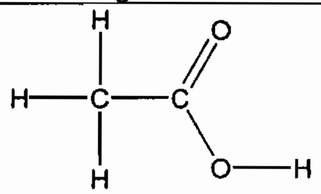
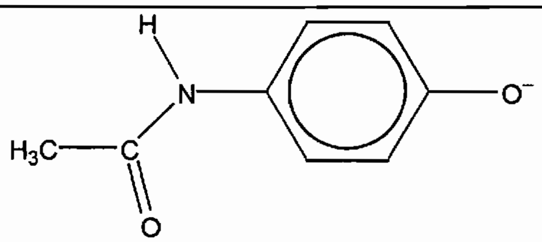
2849 JAN 05

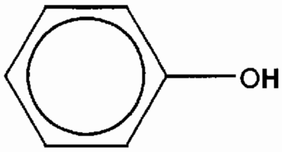
Question	Expected answers	Marks
1 (a)	Amino acids (1).	1
1 (b)	 *1 mark for structure of organic ion and 1 mark for charge on amino group* (2); *1 mark for chloride ion alone* (1).	3
1 (c) (i)	Asymmetric carbon atom / chiral centre (*carbon atom*) / carbon bonded to/ with AW 4 different atoms/groups (1).	1
1 (c) (ii)	Correct 3D structural formula for one enantiomer(1); Mirror images (1).	2
1 (d) (i)	 1 mark for one COOH group and one NH_2 group structure in molecule (1); 1 mark for rest correct for either structure (1).	2
1 (d) (ii)	 1 mark for correct group (1).	1
1 (e) (i)	***One mark each for points in bold** and then any **two** others up to a total of 5 marks:* Reaction/AW takes place at active site; **active sites have specific <u>shapes</u> / enzyme contain hole or cleft with specific shape**; due to the tertiary structure of the enzyme / way it folds; **only one of the enantiomers will fit in the active site AW**; interactions between arginine and active site weaken bonds; activation energy is lowered; **high temperatures cause intramolecular forces to break and active site is lost**; at low temperatures rate is slow since activation energy is not often reached.	5
1 (e) (ii)	Rate = k x [arginine] x [enzyme] *1 mark for* [arginine] and [enzyme] (1); *1 mark for rest correct* (1); $mol^{-1}\ dm^3\ s^{-1}$ (1).	3

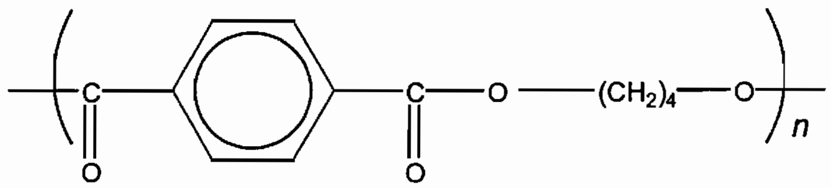
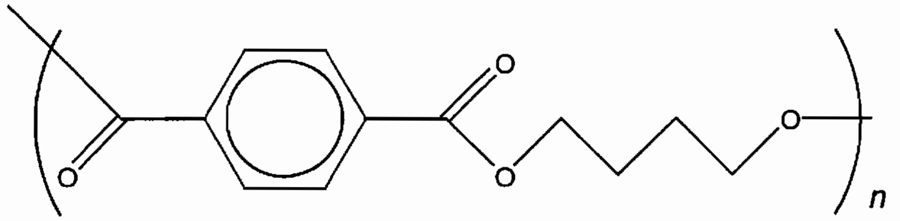
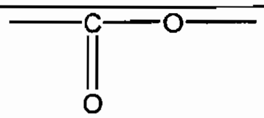
1 (e) (iii)	rate will not alter/rate does not depend on (1); as concentration (of arginine) increases/ concentration (of arginine) (1) AW.	2
	Total mark	**20**

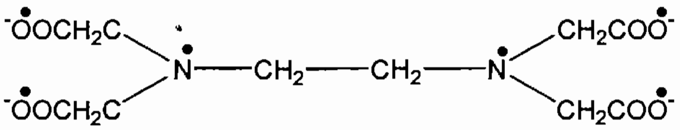
Question	Expected answers	Marks
2 (a) (i)	Carbon (1).	1
2 (b (i)	$Fe \rightarrow Fe^{2+} + 2e^-$ Correct formulae for reactant and product (1); electrons balanced correctly and on RHS (1).	2
2 (b) (ii)	$O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$ Correct formulae reactants and product (1); electrons and formulae balanced correctly and on LHS (1). *Allow halved/doubled equation*	2
2 (b) (iii)	 Arrow correct direction (1); arrow only shown in steel (1).	2
2 (b) (iv)	Oxygen/air (concentration) is lower at **A** than **B** / ora (1).	1
2 (c)	 Correct number of electrons in Fe (*8 electrons*) (1); loss of 2 and 3 electrons respectively for Fe(II) and Fe(III) (1); correct arrangement for all 3 (1).	3
2 (d) (i)	 metals connected to voltmeter only (1); correct solutions (1); salt bridge (1).	3
2 (d) (ii)	0.78 V (1).	1

2 (d) (iii)	$Cu^{2+}(aq)$ + $Fe(s)$ → $Fe^{2+}(aq)$ + $Cu(s)$ *Correct formulae (1);* *state symbols correct, allow for reverse reaction (1).*	2
2 (d) (iv)	(Standard) electrode potential for Fe/Fe(II) is more negative than Cu/Cu(II) ora (1); means Fe is a stronger reducing agent than Cu ora / electrons will flow from Fe (atoms) to Cu(II) (ions) (1); additional/more AW Fe is converted into Fe(II) ions (and hence rust) (1).	3
2 (e)	Rust layer no longer flaky/ layer adheres (more strongly) to steel / impermeable AW (1).	1
	Total mark	**21**

Question	**Expected answers**	*Marks*
3 (a) (i)	**One mark each for points in bold** and then any **two** others up to a total of 5 marks: Dissolve the sample in the minimum amount AW (1); **of hot ethanol** (1); filter (off any solid impurities) (1); **leave (solution/filtrate) to cool/to form crystals** (1); **filter off crystals/decant solution** (1); wash crystals and dry (1). QWC *At least two readable and clear sentences with no more than one spelling, punctuation or grammatical error* (1).	6
3 (a) (ii)	Broad peak/absorbance around 3100 cm^{-1} indicates **OH** (in carboxylic acid) (1); Strong peak/absorbance around 1720 cm^{-1} indicates **C=O** (in carboxylic acid) (1); hence –COOH/ carboxylic acid (1). *The first two marks are for identifying the two important peaks, however much detail is given. These may be shown on the spectrum.*	3
3 (a) (iii)	 Correct molecular formula (1); correct structure, OH not allowed (1).	2
3 (a) (iv)	M_r of acetaminophen =151.0 (1); mass of pure acetaminophen in sample = 0.010 x 151.0 *i.e mol x M_r ecf but not if wrong compound is used to calculate M_r* (1); percentage = (1.510 / 2.00) x 100 = 75.5 % *ecf* (1).	3
3 (b) (i)	Phenol/hydroxyl (1).	1
3 (b) (ii)	 negative ion formed by proton loss (1); correct structure (1).	2
3 (c) (i)	Iron(III) chloride in solution is yellow *accept brown/ yellow or brown + orange/red* (1); phenacetin remains yellow/brown/colour does not change *ecf* (1); acetaminophen turns purple/violet (1).	3

3 (c) (ii)	chemical shifts for **acetaminophen** type of proton relative intensity 4.5 -10.0 (1) *only one peak otherwise no marks*  (1) /phenolic OH chemical shifts for **phenacetin** type of proton relative intensity 3.6 0.8-1.2 (1) *both peaks required* —O—CH_2—R 2 R—CH_3 (1) *both proton types required* 3 (1) *for relative intensities*	5
	Total mark	**25**

Question	**Expected answers**	*Marks*
4 (a) (i)	A molecule is eliminated (often water) in the reaction AW (1); A big molecule/long chain forms from smaller molecules/monomers AW (1) *Do not accept 'polymer' for long chain etc.*	2
4 (a) (ii)	 *or*  ester link correct (1); detail correct (1).	2
4 (a) (iii)	 (1).	1
4 (b)	***One mark each for the two points in bold*** *and then any* ***one*** *other up to a total of 3 marks:* Polymers have crystalline/ordered and amorphous areas (1); in flexible/thermoplastic polymers chains can move past each other (1); **when temperature is lowered/ temperature drops below T_g / then chains/structure eventually become(s) 'frozen'/have less energy** (1); **intermolecular forces unable to be broken therefore chains can no longer slide past each other** (1); if force is applied chains can't move so material breaks (1).	3
4 (d)	Use of copolymers/mixture of monomers (1); use of plasticisers/molecular lubricants (1).	2
	Total mark	**10**

Question	**Expected answers**	***Marks***
5 (a)	Variable oxidation states (1).	1
5 (b)	 1 mark for 6 marked sites (1); all correct (1).	2
5 (c)	Octahedral (1).	1
5 (d) (i)	K = $[[Ni(edta)]^{2-}(aq)]$ / $[[Ni(H_2O)_6]^{2+}(aq)]$ x $[edta^{4-}(aq)]$ Everything correct (2); Wrong way round (1) **or** only powers incorrect (1).	2
5 (d) (ii)	Over to the right AW (1); K_{stab} is a large number / greater than 1(1).	2
5 (d) (iii)	Increasing temperature moves equilibrium position to the left AW (1); less (hydrated) Ni(II) ions are removed from solution/ less complex formed (1).	2

5 (e)	Moles of edta solution = (Concentration x volume) 0.100 x 22.00/1000 (1);
	moles of edta = moles of Ni(II) (1);
	concentration of Ni(II) = 0.00220 x 1000/25.00 (1);
	= 0.0880 / 8.80 x 10^{-2} *3 sig figs* (1).
		4

	Total mark	**14**