OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

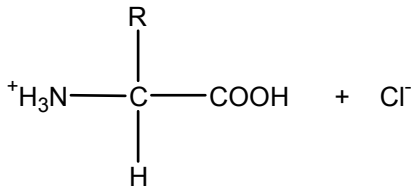
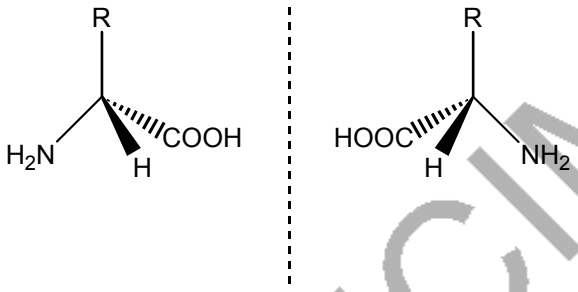
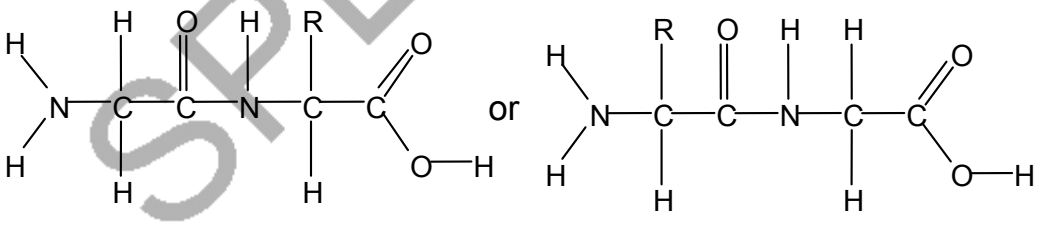
CHEMISTRY B (SALTERS) F334 MS

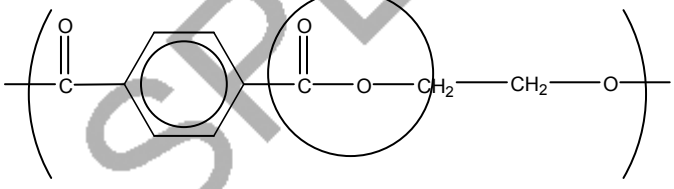
Unit F334: Chemistry of Materials

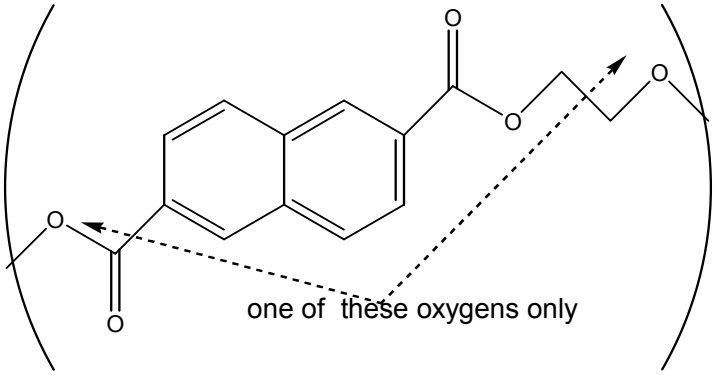
Specimen Mark Scheme

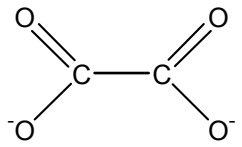
The maximum mark for this paper is **90**.

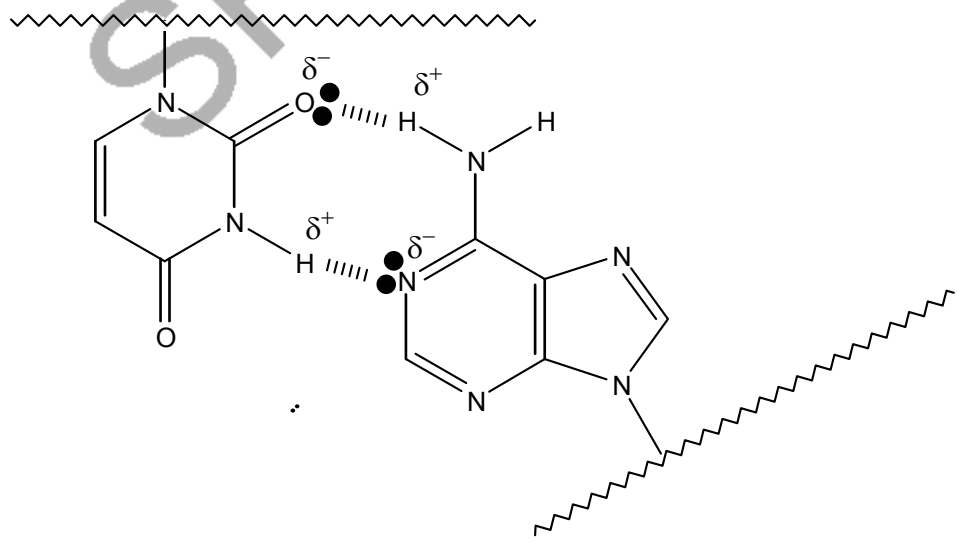
[Turn Over

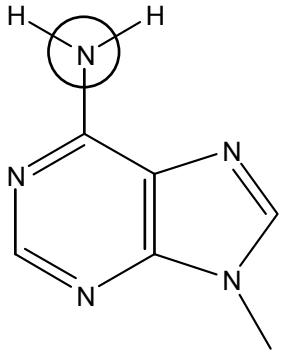
Question Number	Answer	Max Mark
1(a)	Amino acids (1).	**[1]**
(b)	 *1 mark for structure of organic ion and 1 mark for charge on amino group* (2); *1 mark for chloride ion alone* (1).	**[3]**
(c)(i)	Asymmetric carbon atom / chiral centre (*carbon atom*) / carbon bonded to/ with AW 4 different atoms/groups (1).	**[1]**
(ii)	 Correct 3D structural formula for one enantiomer(1); Mirror images (1).	**[2]**
(d)	 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]**

Question Number	Answer	Max Mark
(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 contains 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 bonds to break and active site is lost**; at low temperatures rate is slow since activation energy is not often reached.	**[5]**
(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) *allow any order for units*.	**[3]**
1(e)(iii)	At low [arginine]: rate determining step/ slow step involves 1 molecule of arginine and 1 enzyme molecule forming complex (1); QWC hence first order* (1) At high [arginine]: rds does not involve arginine/rds is breakdown of complex (1) since all enzyme sites are occupied and [complex] is constant (1). QWC relation of one of these two mpts to zero order* [1] *score either one of these.	**[4]**
	Total	**[21]**
2(a)	 (1); *allow without the C within the ring.*	**[1]**
(b)	Burning/combustion (1); Energy produced can be used/reducing landfill (1). recycling AW(1); oil resources saved AW/reducing landfill (1).	**[4]**
(c)	(Below T_g) chains do not have enough **energy** (may describe in terms of vibration or motion of chains) (1); to **move over/slide over one another** (1); **force applied** to change shape of polymer will cause 'frozen' chains to break AW (1).	**[3]**

Question Number	Answer	Max Mark
(d)(i)	 Ester linkage correct (1); rest correct (1) *ignore brackets*.	**[2]**
(ii)	Intermolecular bonds between chains are greater/stronger NOT 'MORE'(1); chains are able to get closer (because of the flat ring system) (1).	**[2]**
(iii)	O–H group present in compound A (1); will give absorbance at 2500-3200 (cm^{-1}) (1)	**[2]**
(e)(i)	Conc. sulfuric acid / c. H_2SO_4 (1); Heat/warm (under reflux)/reflux (1).	**[2]**

Question Number	Answer	Max Mark
(ii)	Condensation	**[1]**
(iii)	PET/PEN are formed by condensation reactions whereas polythene are formed by addition reactions (1); condensation reactions lead to wasted products because elimination reactions occur (1); addition reactions use all reactant atoms (1).	**[3]**
(iv)	TLC plate showing two dots (1); R_f = distance moved by spot/distance moved by solvent front (1)	**[2]**
	Total	**[22]**
3(a)(i)	$[Fe(H_2O)_6]^{3+}$ (1).	**[1]**
(ii)	Oxidation of Fe(II) ions/Fe(II) ion loses electron/ Fe(II) converted to Fe(III) (1); by oxygen/air (1).	**[2]**
(iii)	$Fe^{3+}(aq) + 3OH^-(aq) \rightarrow Fe(OH)_3(s)$ correct formula for $Fe(OH)_3$ (1); balanced equation as above (1) *ignore spectator ions if balanced*; correct state symbols (1).	**[3]**
(b)(i)	 (1).	**[1]**
(ii)	Ligand exchange/complex formation/ligand substitution/Ligand displacement (1).	**[1]**
(iii)	particular frequencies/wavelengths of light/radiation in visible region absorbed (1); hence colour transmitted is light NOT absorbed,(in this case green/ complementary colour is seen (1).	**[2]**
(c)	SO_3^{2-} (1); $E^\ominus$ for half-reactions are more negative than $E^\ominus$ for Fe^{2+}/Fe^{3+} half-reaction / electrons will flow to Fe^{3+} (1). $2Fe^{3+} + SO_3^{2-} + H_2O \rightarrow SO_4^{2-} + 2H^+ + 2Fe^{2+}$ reactants and products correct (1); balanced (1).	**[4]**
	Total	**[14]**
4(a)	$H_2O_2 + 2H^+ + 2e^- \rightarrow 2H_2O$ correct formulae of substances (1); balanced correctly with electrons on left (1).	**[2]**
(b)(i)	Use of pipette for measuring hydrogen peroxide (1); use of burette for manganate(VII) (1) QWC award mark only if spelling of burette is correct; (Use of burette & pipette but with solutions switched is 1 mark only)	

Question Number	Answer	Max Mark
(b)(i) cont'd	addition of sulfuric acid (1) *NOT hydrochloric/nitric acid*; to conical flask with hydrogen peroxide (1); **slow addition at end point/dropwise/drop by drop/slowly/carefully** (1); **to pink/purple colour** (if reverse addition then allow colourless but NOT pink) (1); **repeat to give at least two concordant/consistent readings** (1).	**[7]**
(ii)	Moles of MnO_4^- = (17.2/1000) x 0.0200 (1); moles of H_2O_2 = **2.5** x (17.2/1000) x 0.0200 (1) *ecf*; *mark is for the 2.5* ratio concentration of undiluted = **2.5** x (17.2/1000) x 0.0200 x (1000/10.0) x 10 (1); concentration 0.860 mol dm^{-3} (1) *ecf but answer must be to 3 sig. figs*.	**[4]**
(iii)	M_r of H_2O_2 = 34 (1); mass of H_2O_2 in 100 cm^3 of water = 34 x 0.86 x 100/1000 = 2.9 g *or* max moles of H_2O_2 allowed in 100 cm^3 of water = 3.0/34 = 0.088 mol therefore YES (1) *ecf from* (iii) *and* M_r of H_2O_2.	**[2]**
(c)(i)	$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$ *formulae correct, balanced and state symbols correct* (1).	**[1]**
(ii)	Fe^{2+} can reduce/lose electrons to one reactant to form a product and Fe^{3+} (1); Fe^{3+} can then oxidise/lgain electrons from a reactant to reform Fe^{2+} (1); both reactions are faster than the uncatalysed reaction/ E_a for both is lower AW (1).	**[3]**
(iii)	Measure volume of oxygen by syringe/over water (1); plot graph of volume of O_2 v time (1); find gradient at time = 0 (1).	**[3]**
(iv)	Rate of decomposition = k x $[H_2O_2]$ (1); = 2.0 x 10^{-6} (x 5.0) mol dm^{-3} s^{-1} = 4.0 x 10^{-6} mol dm^{-3} s^{-1} *ecf* (1).	**[2]**
5(a)(i)	 **one mark for both hydrogen bonds (1);** **one mark for both lone pairs (1);** **partial charges correct (1);**	

Question Number	Answer	Max Mark
5(a)(i) cont'd	If only one interaction shown but all three components are correct then give 2 marks out of 3; Y= adenine and uracil completed correctly (1); sugar = deoxyribose (1).	**[4]**
(ii)	 Lone pair of electrons on N (1); can accept proton/hydrogen ion/H^+ (1).	**[3]**
(iii)	Double helix (1).	**[1]**
(b)	It explains all the known facts about DNA/ it helps predict facts/properties/reactions which can be tested and shown to be correct (1).	**[1]**
	Total	**[9]**
	Paper Total	**[90]**