Question Number	Acceptable Answers	Reject	Mark
1 (a)(i)	Conc. Nitric acid **(1)** Conc. Sulfuric acid **(1)** Allow correct formulae Ignore state symbols Sulfuric acid and nitric acid with no mention of concentrated scores (1)		**2**

Question Number	Acceptable Answers	Reject	Mark
1 (a)(ii)	Pear shaped/round bottomed flask & heat source **(1)** Allow vertical arrow with or without the word heat Allow water bath as a heat source Liebig condenser, shown vertically **(1)** (Water) flow shown correctly into a jacket **(1)** Ignore thermometers unless stoppered Penalise (one for each): Stopper/sealed Gaps between flask and condenser Condenser inner tube extends into liquid in flask	Conical flask in diagram or label	**3**

Question Number	Acceptable Answers	Reject	Mark
1 (a)(iii)	Heat Speed up reaction / to overcome the activation energy / provide energy to break bonds / because activation energy for the reaction is high **(1)** Under reflux Prevent escape of reactants / products Or As they may be flammable / harmful / volatile **(1)**	Just to provide energy for the reaction to start Just to increase the yield/make reaction go to completion	**2**

Question Number	Acceptable Answers	Reject	Mark
1 (a)(iv)	$HOCH_2CH_2N(C_2H_5)_2$ Allow $OHCH_2CH_2N(C_2H_5)_2$ Allow displayed or skeletal formulae		**1**

Question Number	Acceptable Answers	Reject	Mark
1 (a)(v)	Reduction **(1)** Allow redox Tin / iron / zinc **and** (conc./dilute) hydrochloric acid **(1)** Accept correct names or formulae for both alternatives Ignore references to tin as a catalyst Ignore conditions Allow $NaBH_4$ in alkali (Pd catalyst)	Addition of NaOH unless clearly after the reduction Hydrogen gas and nickel (catalyst) $LiAlH_4$	**2**

Question Number	Acceptable Answers	Reject	Mark
1 (b)(i)	Moles of 2-hydroxy benzoic acid = 9.4/138 **(1)** (= 0.0681) So theoretical yield of aspirin = 0.0681 x 180 **(1)** = 12.26 g % yield = 100 x 7.77/12.26 = 63.4% **(1)** Or Moles of 2-hydroxy benzoic acid = 9.4/138 **(1)** (= 0.0681) Moles of aspirin = 7.77/180 **(1)** (=0.0432) % yield = 100 x 0.0432/0.0681 = 63.4/63% **(1)** Correct answer with no working 3 marks Allow 1 max. if *M*r values are transposed 108%	100 x 7.77/9.40 = 82.7%	**3**

Question Number	Acceptable Answers	Reject	Mark
1 *(b)(ii)	Dissolve/add to impure solid in min. volume / amount **(1)** of hot solvent / water **(1)** (Filter whilst hot) Allow to cool **and** filter off product / (re)crystallize **and** filter off product **(1)** Wash with cold / small amount of solvent / water (then dry) **(1)**	Just 'small/little amount of water' Named solvents other than water – penalise once	**4**

Question Number	Acceptable Answers	Reject	Mark
1 (b)(iii)	It reduces yield as some product remains in solution Allow stated and explained errors due to transfer e.g. left on filter paper	Just 'transfer errors'	**1**

Question Number	Acceptable Answers	Reject	Mark
1 (c)(i)	CH_3COCl / $(CH_3CO)_2O$ / ethanoyl chloride / ethanoic anhydride If both name and formula are given then both must be correct Allow acetyl chloride / acetic anhydride Ignore any additional information Allow displayed formulae	Ethanoic acid	**1**

Question Number	Acceptable Answers	Reject	Mark
1 (c)(ii)	(Lessen) risk of overdose / as paracetamol is toxic in larger doses/ as paracetamol is harmful in larger doses / reduce risk of taking medication over a longer time period than necessary / reduce risk of addiction		**1**

Question Number	Acceptable Answers	Reject	Mark
1 (c)(iii)	Net forces between paracetamol and water are less than the forces between water and water and / or paracetamol and paracetamol Allow benzene / ring doesn't interact with water Allow benzene ring is hydrophobic / non polar / only forms London forces / can't form hydrogen bonds	Just paracetamol / benzene ring is large / steric hindrance	**1**

Question Number	Acceptable Answers	Reject	Mark
2(a)(i)	C 60/12 = 5 H 8/1 = 8 O 32/16 = 2 ALLOW 1 mol = 100 g So 60 %C = C_5, etc		**1**

Question Number	Acceptable Answers	Reject	Mark
2(a)(ii)	**C=C** **Test** : add bromine water/Br_2(aq) **(1)** **Result**: From yellow/brown/red-brown/orange to colourless/decolorises **(1)** OR **Test** : add (acidified) potassium manganate((VII)) (solution) **(1)** **Result**: goes from pink/purple to colourless/brown **(1)** **Test** : add alkaline potassium manganate((VII)) (solution) **(1)** **Result**: goes green **(1)** **COOH:** **Test** : add $NaHCO_3$ /Na_2CO_3/sodium carbpnate (solution) **(1)** **Result**: Fizzes/bubbles/large volume neutralized **(1)**	 Bromine/Br_2/Br_2(l) clear for colourless clear for colourless PCl_5 /$LiAlH_4$ as test NaOH/NaOH(aq) colourless gas evolved	**4**

	ALLOW gas given off that turns limewater cloudy OR **Test** : with **blue** litmus **(1)** **Result**: turns red **(1)** The test can be with any other indicator, including universal indicator, with the correct initial and final colour ALLOW pH meter **(1)** pH 4-6 **(1)** OR **Test** : add ethanol with conc H_2SO_4 (and warm) **(1)** **Result**: gives pleasant/fruity smell of ester **(1)** OR **Test:** add magnesium **(1)** **Result:** fizzing/bubbles etc (of hydrogen) **(1)** ALLOW gas given off that burns with a squeaky pop	Add sodium colourless gas evolved	

Question Number		Reject	Mark
2(b)(i)	Explanation of precedence/priority in terms of atomic numbers/masses of the attached groups OR Highest-precedent/priority groups on each carbon are on opposite sides of the molecule **(1)** *E*-/entgegen **(1)** Mark independently	Both CH_3/methyl groups on the same side so Z (0/2)	**2**

Question Number	Acceptable Answers	Reject	Mark
2(b)(ii)	45 $COOH^+$ /CO_2H^+ **(1)** 55 $C_4H_7^+$ OR $C_3OH_3^+$ **(1)** ALLOW Structural/displayed formulae of ions Absence of + charge (1 max)		**2**

Question Number	Acceptable Answers	Reject	Mark
2(b)(iii)	If they say yes **(0)** (No) (Cleavage of the C—COOH bond in) both compounds gives fragment(s) of the same mass OR Both give the same peak(s)/fragment(s) Both give CO_2H^+/ $C_4H_7^+$ fragments The mark can be scored by referring to just one of the fragments/peaks/masses.	 'No' on its own	**1**

Question Number	Acceptable Answers	Reject	Mark
***2(c)(i)**	**C** is CH_3CHO (alone) **(2)** **D** is $CH_3COCOOH$ (alone) **(2)** so tiglic acid must be **B** **(1)** tiglic acid mark can only be awarded if correct structures of either **C** or **D** are given. **Any one of the following** **C** must be an aldehyde **(1)** **D** is a ketone **(1)** Mention that CH_3CO present in either/both compounds (because of formation of iodoform) **(1)** If one or both of the structures are incorrect any of the last 3 marks can be awarded max 5 If C and D are fully correct, but the wrong way round max 5	CH_3COH **1 max**	**6**

Question Number	Acceptable Answers	Reject	Mark
2(c)(ii)	Doesn't distinguish *E*- isomer from *Z*-isomer/geometric isomers (so no) OR Doesn't distinguish which sides of C=C functional groups are on	Just isomers/ stereoisomers/ enatiomers	**1**

Question Number	Acceptable Answers	Reject	Mark
2(d)(i)	CH_3CHO **(1)** ACCEPT displayed or skeletal **Step 1** (heat)using acidified potassium dichromate/or $H^+/Cr_2O_7^{2-}$ **(1)** distil (product as formed) conditional on dichromate **(1)** **Step 2** HCN with KCN OR KCN with H^+/acid OR KCN with (cold) NaOH(aq)/alkali **(1)** ALLOW HCN with NaOH/alkali For step 2 Ignore conditions e.g. any references to heat	CH_3COH Manganate VII/$KMnO_4$ Reflux HCN alone	**4**

Question Number	Acceptable Answers	Reject	Mark
2(d)(ii)	**Nucleo**philic addition Any recognisable spelling of 'philic' and addition, either order **Both** words needed	**Nutro**philic addition Any other or additional words	**1**

Question Number	Acceptable Answers	Reject	Mark
***2(d)(iii) QWC**	Ethanal is planar (at the reaction site) OR Ethanal is a planar molecule **(1)** Attack (from CN^- to give the cyanohydrin) is (equally likely) from either side/above or below/from both sides (of the molecule) (so a racemic mixture is formed) **(1)** Mark independently	Intermediate is planar Square planar Can attack carbocation from either side/any reference to SN1/SN2	**2**

Question Number	Acceptable Answers	Reject	Mark
2(d)(iv)	Receptors for the compound in the body are often stereospecific so only one stereoisomer is pharmacologically active OR Body recognises one (stereo)isomer ALLOW Only one (stereo)isomer is active OR One/the other isomer may be toxic/dangerous/harmful OR One isomer destroys body cells OR (Different) isomers have different biological/pharmacological/biochemical properties		**1**