

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

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

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

Question Number	Acceptable Answers	Reject	Mark
1 (a)(iv)	HOCH ₂ CH ₂ N(C ₂ H ₅) ₂ Allow OHCH ₂ CH ₂ N(C ₂ H 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 Mr 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 ₃ COCl / (CH ₃ CO) ₂ O / 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)	<p>Net forces between paracetamol and water are less than the forces between water and water and / or paracetamol and paracetamol</p> <p>Allow benzene / ring doesn't interact with water</p> <p>Allow benzene ring is hydrophobic / non polar / only forms London forces / can't form hydrogen bonds</p>	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)	<p>C=C</p> <p>Test : add bromine water/Br₂(aq) (1)</p> <p>Result: From yellow/brown/red-brown/orange to colourless/decolorises (1)</p> <p>OR</p> <p>Test : add (acidified) potassium manganate((VII)) (solution) (1)</p> <p>Result: goes from pink/purple to colourless/brown (1)</p> <p>Test : add alkaline potassium manganate((VII)) (solution) (1)</p> <p>Result: goes green (1)</p> <p>COOH:</p> <p>Test : add NaHCO₃/Na₂CO₃/sodium carbonate (solution) (1)</p> <p>Result: Fizzes/bubbles/large volume neutralized (1)</p>	<p>Bromine/Br₂/Br₂(l)</p> <p>clear for colourless</p> <p>clear for colourless</p> <p>PCl₅/LiAlH₄ as test</p> <p>NaOH/NaOH(aq)</p> <p>colourless gas evolved</p>	4

	<p>ALLOW gas given off that turns limewater cloudy</p> <p>OR</p> <p>Test : with blue litmus (1)</p> <p>Result: turns red (1)</p> <p>The test can be with any other indicator, including universal indicator, with the correct initial and final colour</p> <p>ALLOW pH meter (1)</p> <p>pH 4-6 (1)</p> <p>OR</p> <p>Test : add ethanol with conc H_2SO_4 (and warm) (1)</p> <p>Result: gives pleasant/fruity smell of ester (1)</p> <p>OR</p> <p>Test: add magnesium (1)</p> <p>Result: fizzing/bubbles etc (of hydrogen) (1)</p> <p>ALLOW gas given off that burns with a squeaky pop</p>	<p>Add sodium</p> <p>colourless gas evolved</p>	
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Question Number		Reject	Mark
2(b)(i)	<p>Explanation of precedence/priority in terms of atomic numbers/masses of the attached groups</p> <p>OR</p> <p>Highest-precedent/priority groups on each carbon are on opposite sides of the molecule (1)</p> <p><i>E</i>-/entgegen (1)</p> <p>Mark independently</p>	Both CH ₃ /methyl groups on the same side so Z (0/2)	2

Question Number	Acceptable Answers	Reject	Mark
2(b)(ii)	<p>45 COOH⁺ /CO₂H⁺ (1)</p> <p>55 C₄H₇⁺</p> <p>OR</p> <p>C₃OH₃⁺ (1)</p> <p>ALLOW Structural/displayed formulae of ions</p> <p>Absence of + charge (1 max)</p>		2

Question Number	Acceptable Answers	Reject	Mark
2(b)(iii)	<p>If they say yes (0)</p> <p>(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)</p> <p>Both give CO₂H⁺/ C₄H₇⁺ fragments</p> <p>The mark can be scored by referring to just one of the fragments/peaks/masses.</p>	'No' on its own	1

Question Number	Acceptable Answers	Reject	Mark
*2(c)(i)	<p>C is CH₃CHO (alone) (2)</p> <p>D is CH₃COCOOH (alone) (2)</p> <p>so tiglic acid must be B (1)</p> <p>tiglic acid mark can only be awarded if correct structures of either C or D are given.</p> <p>Any one of the following</p> <p>C must be an aldehyde (1)</p> <p>D is a ketone (1)</p> <p>Mention that CH₃CO present in either/both compounds (because of formation of iodoform) (1)</p> <p>If one or both of the structures are incorrect any of the last 3 marks can be awarded max 5</p> <p>If C and D are fully correct, but the wrong way round max 5</p>	CH ₃ COH 1 max	6

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

Question Number	Acceptable Answers	Reject	Mark
2(d)(i)	<p>CH₃CHO (1)</p> <p>ACCEPT displayed or skeletal</p> <p>Step 1</p> <p>(heat)using acidified potassium dichromate/or H⁺/Cr₂O₇²⁻ (1)</p> <p>distil (product as formed) conditional on dichromate (1)</p> <p>Step 2</p> <p>HCN with KCN</p> <p>OR</p> <p>KCN with H⁺/acid</p> <p>OR</p> <p>KCN with (cold) NaOH(aq)/alkali (1)</p> <p>ALLOW HCN with NaOH/alkali</p> <p>For step 2 Ignore conditions e.g. any references to heat</p>	<p>CH₃COH</p> <p>Manganate VII/KMnO₄</p> <p>Reflux</p> <p>HCN alone</p>	4

Question Number	Acceptable Answers	Reject	Mark
2(d)(ii)	<p>Nucleophilic addition</p> <p>Any recognisable spelling of 'philic' and addition, either order</p> <p>Both words needed</p>	<p>Nutrophilic addition</p> <p>Any other or additional words</p>	1

Question Number	Acceptable Answers	Reject	Mark
*2(d)(iii) QWC	<p>Ethanal is planar (at the reaction site)</p> <p>OR</p> <p>Ethanal is a planar molecule (1)</p> <p>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)</p> <p>Mark independently</p>	<p>Intermediate is planar</p> <p>Square planar</p> <p>Can attack carbocation from either side/any reference to SN1/SN2</p>	2

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

