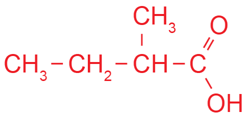
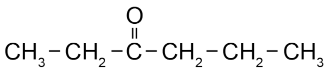
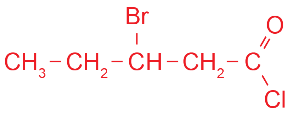
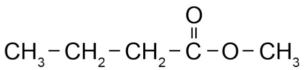
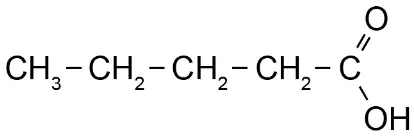
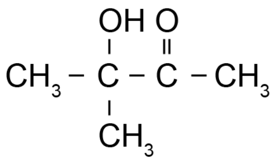
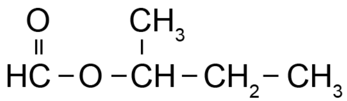
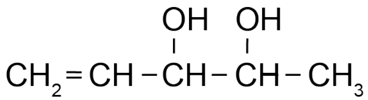
Assessment Schedule – 2021

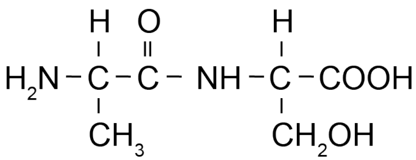
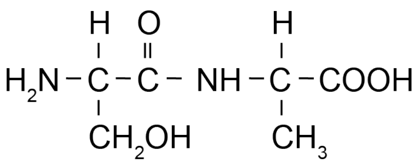
Chemistry: Demonstrate understanding of the properties of organic compounds (91391)

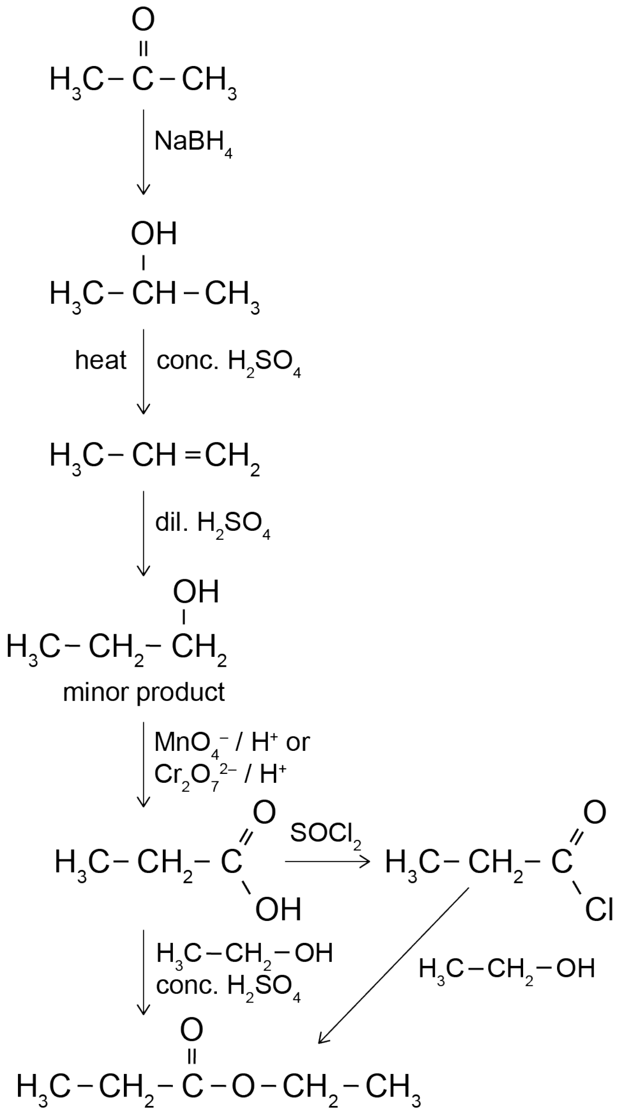
Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	<table><tr><th>Structural formula</th><th>IUPAC (systematic) name</th></tr><tr><td></td><td>2-methylbutanoic acid</td></tr><tr><td></td><td>hexan-3-one</td></tr><tr><td></td><td>3-bromopentanoyl chloride</td></tr><tr><td></td><td>methyl butanoate</td></tr></table>	THREE correct.		

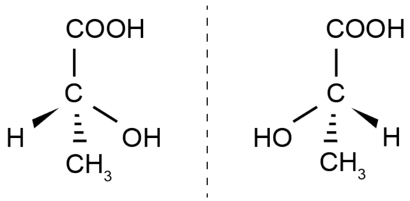
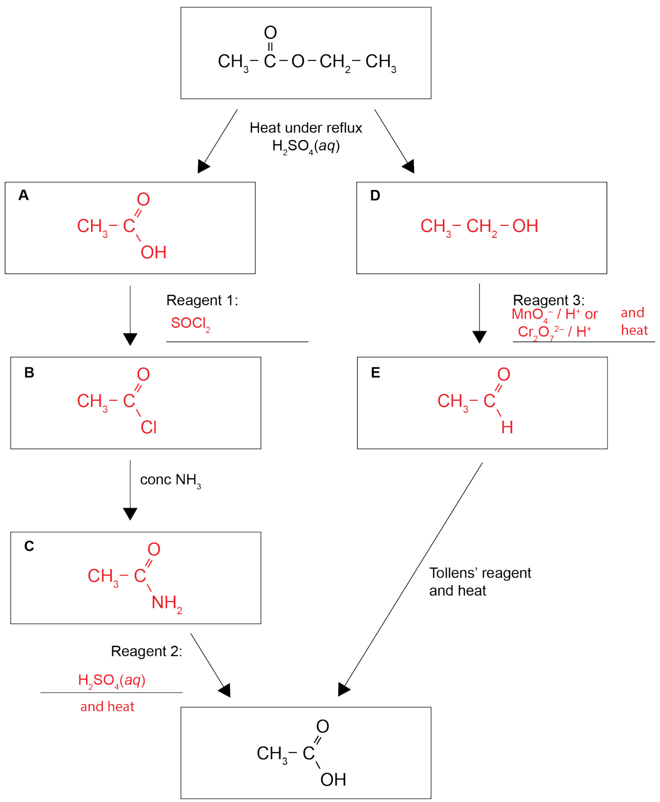
(b)(i)		• ONE structural formula. • Correct functional groups present for at least TWO structural formulae.	• TWO structural formulae.	THREE structural formulae.
(ii)				
(iii)				
(iv)	 OH groups can also be on carbons 2 and 3 or carbons 2 and 4.			
(c)(i)	1 = Distillation 2 = Reflux	• BOTH processes correctly named AND oxidation reaction stated.		
(ii)	When oxidising pentan-1-ol by heating it with acidified permanganate (MnO_4^- / H^+), distillation is used to produce pentanal. Distillation separates organic molecules by evaporating and condensing molecules based on boiling points. Pentanal is an aldehyde with a lower boiling point than pentan-1-ol so it vaporises when heated and is then condensed and collected before it is further oxidised to a carboxylic acid. The reflux process is used because it ensures that volatile molecules are contained when the reaction is heated so that pentan-1-ol is fully oxidised to pentanoic acid. As the pentan-1-ol is heated with acidified permanganate, it produces pentanal, which vaporises. As, it travels upwards, the vapour is condensed in the condenser, and drops back into the reaction mixture to be further oxidised to pentanoic acid.	• Recognises distillation purifies / separates molecules with different boiling points. OR Recognises heating under reflux prevents loss of volatile products. • Recognises partial vs full oxidation	• Links distillation process to lower boiling point of pentanal/ the prevention of further oxidation. • Links the reflux process to complete oxidation reaction.	• Fully explains the use of both processes to produce the desired organic products.

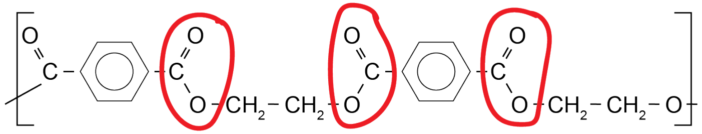
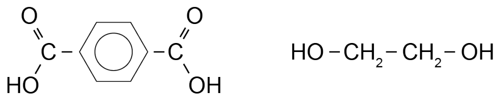
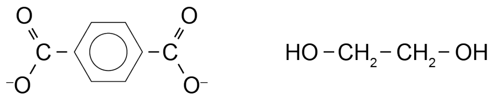
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	1a	2a	3a	4a	2m	3m	2e with minor error / omission	2e

Q	Evidence	Achievement	Merit	Excellence
TWO (a)(i)	Add water. The propanoyl chloride undergoes a substitution reaction to form propanoic acid, CH_3CH_2COOH. The mixture will react vigorously with the water and produce steamy fumes. The propanamide will not react.	• TWO correct reagents AND observations. • TWO correct reaction types. • ONE correct structural formula of organic product.	• TWO pairs of compounds distinguished with THREE reagents, observations, reaction type, structural formulae.	• ALL pairs of compounds distinguished with reagents, conditions, observations, reaction type, and structural formulae of organic products.
(ii)	Add Tollens' reagent and heat. The propanal will form a silver mirror, since the propanal is oxidised to propanoic acid, CH_3CH_2COOH. OR: Add Benedict's (Fehlings) reagent and heat. The propanal will form an orange-red solid, since the propanal is oxidised to propanoic acid, CH_3CH_2COOH. In both cases, there is no reaction with the propan-2-ol.			
(iii)	Add bromine water. The propene undergoes an addition reaction to form 1,2-dibromopropane, $CH_3CHBrCH_2Br$. The bromine water will change from orange to colourless. The methyl ethanoate will not react. OR: Add potassium permanganate. The propene undergoes an oxidation reaction to form propan-1,2-diol, $CH_3CH(OH)CH_2OH$. The potassium permanganate will change from purple to a brown solid. The methyl ethanoate will not react.			
(b)	 	• Correct amide linkage.	• BOTH dipeptides correctly drawn.	

(c)		• Recognises that a reduction reaction occurs in the first step. • Ester formed from correct organic molecules.	• THREE correct steps. OR Correct pathway with minor omissions.	• Correct process to create ethyl propanoate, including all structural formulae and reagents/conditions.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	1a	2a	3a	4a	2m	3m	2e with minor error / omission	2e

Q	Evidence	Achievement	Merit	Excellence
THREE (a)(i)		• Recognises tetrahedral arrangement of correct atoms / groups about asymmetric C atom.	• BOTH 3-D images drawn correctly. AND Explains enantiomers can rotate (plane-) polarised light in opposite directions.	
(ii)	The enantiomers can be distinguished based on their ability to rotate plane polarised light. One enantiomer will rotate the plane-polarised light to the left, while the other enantiomer will rotate the plane-polarised light to the right.	• Identifies enantiomers rotate (plane-) polarised light.		
(b)		• Any THREE answers correct.	• FIVE answers correct, including at least ONE reagent.	• ALL structural formulae, reagents, and conditions correct.

(c)(i)		• Any one ester functional group circled.		
(ii)	A hydrolysis reaction uses water to split a large organic molecule into smaller organic molecules. The C=O gains –OH from water, and the C–O gains –H from water. Both acidic and basic hydrolysis require heat under reflux. Acidic hydrolysis requires a dilute acid (e.g. dil. H_2SO_4), whereas basic hydrolysis requires a dilute base (e.g. dil. NaOH). Acid hydrolysis  Basic hydrolysis 	• Describes a hydrolysis reaction OR provides reagents and conditions. • Correct structural formula for ONE product.	• Explains the hydrolysis reaction, including reagents and, structural formulae for at least TWO products.	• Fully elaborates on the acidic and basic hydrolysis of PET, including ALL correct structural formulae of products.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	1a	2a	3a	4a	2m	3m	2e with minor error / omission	2e

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 12	13 – 18	19 – 24