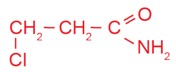
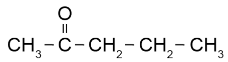
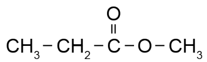
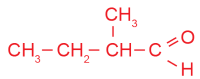
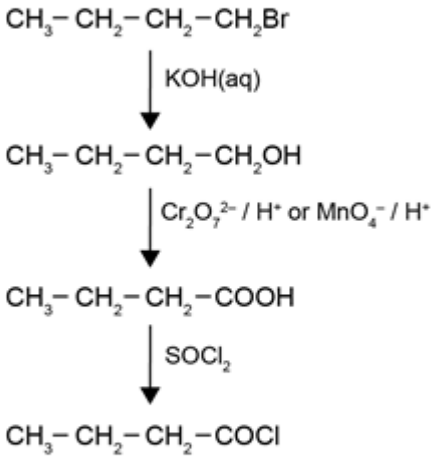
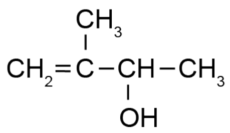
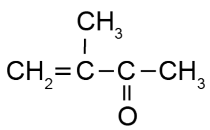
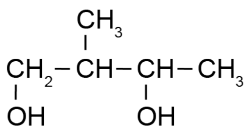
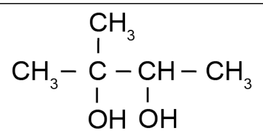
Assessment Schedule – 2020

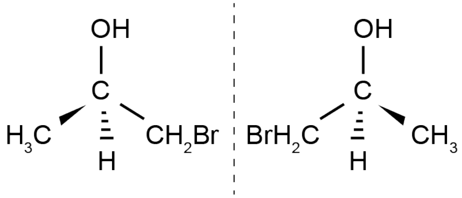
Chemistry: Demonstrate understanding of the properties of organic compounds (91391)

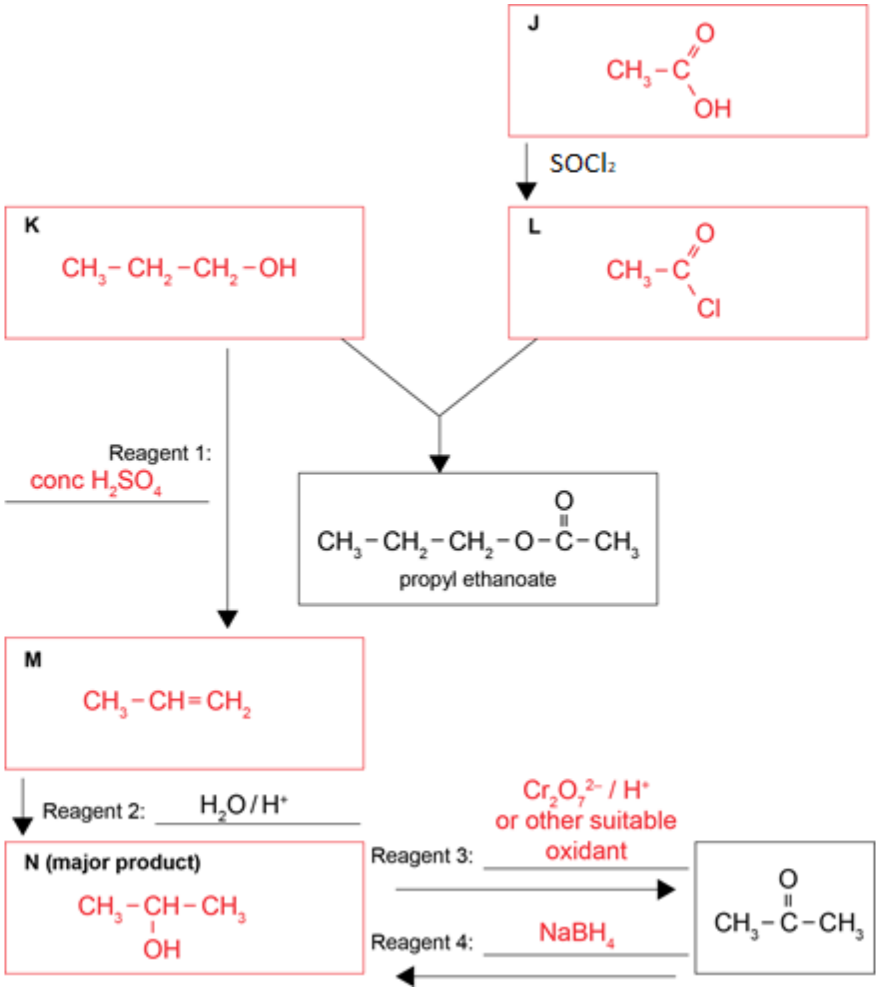
Evidence Statement

<table>
<tr><th>Q</th><th>Evidence</th><th>Achievement</th><th>Merit</th><th>Excellence</th></tr>
<tr><td>ONE (a)(i)</td><td>
<table>
<tr><th>Compound</th><th>IUPAC (systematic) name</th><th>Structural Formula</th></tr>
<tr><td>A</td><td>3-chloropropanamide</td><td></td></tr>
<tr><td>B</td><td>pentan-2-one</td><td></td></tr>
<tr><td>C</td><td>methyl propanoate</td><td></td></tr>
<tr><td>D</td><td>2-methylbutanal</td><td></td></tr>
</table>
</td><td>• TWO correct.</td><td></td><td></td></tr>
<tr><td>(ii)</td><td>Add blue Benedict's solution to compound D and warm. A (brick) red solid/precipitate will form, (as the Cu^{2+} ions are reduced to Cu^{+}). This happens because compound D is an aldehyde and has been oxidised to a carboxylic acid:
$CH_3 – CH_2 – CH(CH_3) – COOH$
OR
Add Tollens' reagent to compound D and warm. Solid silver will form on the walls of the test tube, (as the silver ion from the Tollens' reagent is reduced to silver atoms). This happens because compound D is an aldehyde and is oxidised to a carboxylic acid (structure given above).
Note: Can also use either acidified potassium dichromate (orange to green colour change) or acidified potassium permanganate (purple to colourless colour change).
No change will occur with compound B since ketones cannot be further oxidised.</td><td>• Identifies a correct reagent.
• Provides correct observations.
OR
Correct reaction type.
OR
Correct product.</td><td>• Fully explains a chemical test to distinguish B and D.</td><td></td></tr>
</table>

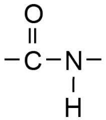
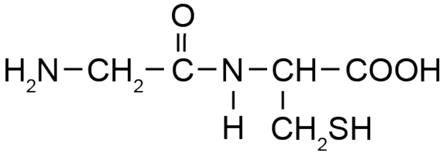
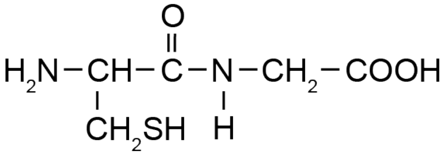
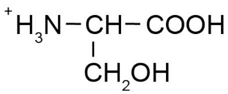
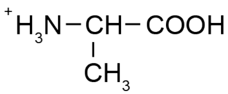
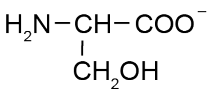
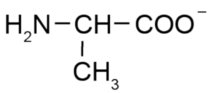
(b)		• ONE step of reaction scheme correct.	• TWO steps of reaction scheme correct.	• Complete reaction scheme with all organic products, reagents, and any conditions correct.
(c)	**Organic molecule** / **Structural formula** **S**  **T**  **U**  **V** 	• ONE structure correct. OR TWO structures correct following on from incorrect S.	• TWO structures correct. OR THREE structures correct following on from incorrect S.	• ALL structures correct.

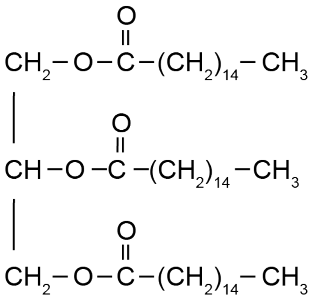
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	1a	2a	3a	4a	2m	3m	2e, but allow minor error / omission in one question	2e

Q	Evidence	Achievement	Merit	Excellence
TWO (a)(i)		• Recognises tetrahedral arrangement about asymmetric carbon atom.	• Both 3-D images drawn correctly, identifies asymmetric carbon, and explains how enantiomers could be distinguished.	
(ii)	1-bromopropan-2-ol exists as enantiomers as it has an asymmetric carbon atom, i.e. a carbon which is attached to four different atoms or groups of atoms. In this case, carbon 2 is the asymmetric carbon. (This makes the molecule chiral.)	• Identifies presence of asymmetric carbon. OR Recognises an appropriate property to distinguish enantiomers.		
(iii)	The enantiomers can be distinguished since they rotate plane polarised light in opposite direction.			
(b)	Add water to all three liquids. Only butanoyl chloride will vigorously react and produce steamy fumes of HCl(*g*). This is a substitution/hydrolysis reaction and will form butanoic acid, $CH_3–CH_2–CH_2–COOH$. Add sodium carbonate solution to the remaining two liquids. Only butanoic acid will produce bubbles of CO_2(*g*). This is an acid-base reaction and produces sodium butanoate, $CH_3–CH_2–CH_2–COO^-Na^+$. Add acidified potassium permanganate to the remaining liquid. The butan-2-ol will turn the purple potassium permanganate colourless. This is an oxidation reaction and produces butanone, $CH_3–CH_2–CO–CH_3$.	• States TWO observations. • Identifies TWO of the reaction types occurring. OR One correct structural formula of an organic product.	• Identifies correct tests and observations for TWO liquids plus ONE correct reaction type and ONE correct structural formula of an organic product.	• Develops a valid procedure to identify all THREE liquids including correct tests, observations, reaction types, and at least TWO correct structural formulae of organic products.

(c)		• Any FOUR answers correct.	• Any SIX answers correct.	• ALL structures and reagents correct

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	1a	2a	3a	4a	2m	3m	2e, but allow minor error / omission in one part.	2e

Q	Evidence	Achievement	Merit	Excellence
THREE (a)		• One peptide (amide) bond circled.		
(b)(i)	 	• ONE dipeptide correct OR TWO mostly correct with minor error	• BOTH dipeptides correct.	
(ii)	In this hydrolysis reaction, water is used to break the larger organic molecule into smaller organic molecules. (In this reaction, the amide/peptide bond is broken). Hydrolysis occurs in both acidic and basic conditions (using an aqueous acid such as HCl or aqueous base such as NaOH). The rate of reaction for both can be increased by heating under reflux. Products from acidic hydrolysis   Products from basic hydrolysis  	• Describes a hydrolysis reaction. • ONE structure correct.	• Explains the hydrolysis reaction, including reagents. • TWO structures correct.	• All FOUR correct structures from hydrolysis. AND Fully explains hydrolysis and requirements.

(c)(i)		• Correct ester linkage drawn.	• Correct structure.	• Correct structure, explanation of condensation, and explanation of advantages of heating under reflux.
(ii)	This is a condensation reaction because smaller organic molecules (glycerol and fatty acids) join together to make a larger organic molecule (triglyceride). In the process, water is eliminated. (One water molecule is eliminated for each ester linkage)	• Describes a condensation reaction	• Explains condensation. OR Explains ONE advantage of heating under reflux.	
(iii)	Heating under reflux is an advantage as it condenses volatile organic molecules that have turned into gases back into liquids. This allows the reaction to go to completion and ensures none of the reactants / products escape, thus increasing the yield of the product. This also means the reaction can be heated without the risk of losing reactant / product, so the rate of the reaction increases.	• States one advantage of heating under reflux.		

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	1a	2a	3a	4a	3m	4m	2e, but allow minor error/omission in one part.	2e

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 8	9-13	14-19	20 – 24