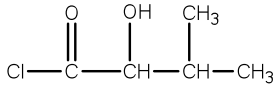
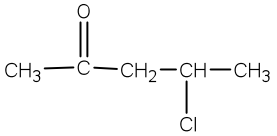
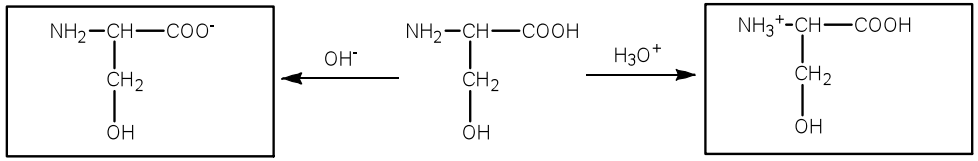
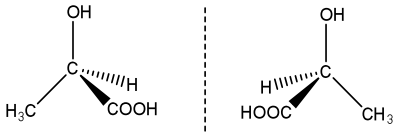
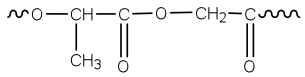
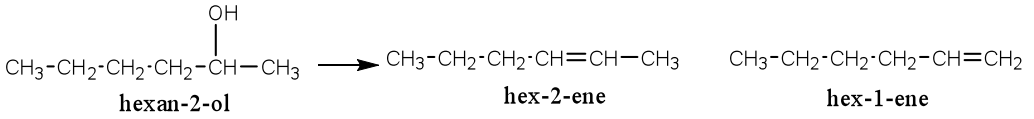
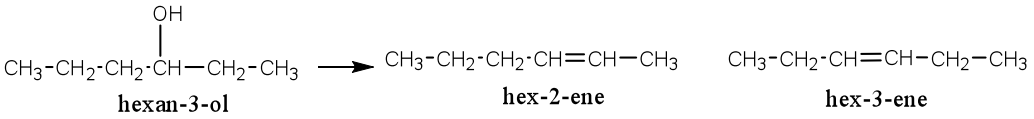
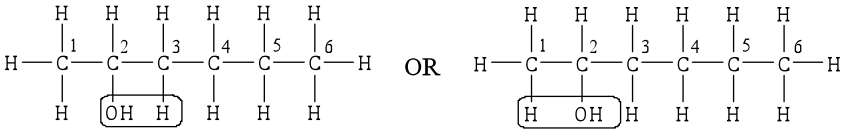
Assessment Schedule – 2018 NZIC
Chemistry: Demonstrate understanding of the properties of organic compounds (91391)
Evidence Statement

	Evidence	Achieved	Merit	Excellence
Q1 (a)	<table><tr><th>Compound</th><th>Structural Formula</th><th>IUPAC systematic name</th></tr><tr><td>**A**</td><td></td><td>**3,3-dimethylheptanamide**</td></tr><tr><td>**B**</td><td>  </td><td></td></tr><tr><td>**C**</td><td></td><td>**2-amino-3-hydroxy-propanoic acid**</td></tr><tr><td>**D**</td><td>  </td><td></td></tr></table>	2 of 4 structures/names	All names and structures correct	
(b)		One reaction product correct	• Two of: acid reaction product, base reaction product or recognises hydrolysis reaction of amides	Compares and contrasts amine and amide reactions with acid and base including correct products for one of the reactions.
(c)	**Compound A** is an amide with no basic or acidic functional groups so it will not react in the same way as **Compound C** which has both a basic amine ($-NH_2$) group and an acidic (-COOH) group. The amide group in **Compound A** is hydrolysed in acid or base solution. With acid, it forms the carboxylic acid and a salt, with base it forms the salt of the carboxylic acid and ammonia gas.	Recognises hydrolysis reaction of amides	• Distinguishers enantiomers and correctly draws the two enantiomers	
(d)(i)	Lactic acid has a chiral carbon – i.e. 4 different groups attached. This means that it has two possible structural arrangements that are non-superimposable mirror images.	Recognises chiral centre OR Drawing of both enantiomers	• Links functional groups to reaction to form condensation polymer OR polymer structure correctly links the two monomers	
(ii) (iii)	The two enantiomers will rotate the plane of polarised light by equal and opposite amounts. 			All aspects of enantiomer discussions
(vi)	These molecules contain two functional groups-OH and –COOH, that can react, given the right conditions, to form an ester group. This is a condensation reaction resulting in the elimination of a water molecule. Polymerisation occurs when each molecule interacts with two other molecules, which then join into a long chain, this creating a polymer molecule. 	Recognises ester formation from acid and alcohol Polymer structure show correct linkages		All aspects of polymer discussions including diagrams

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

	Evidence	Achieved	Merit	Excellence
TWO (a)(i) (ii)	Concentrated H_2SO_4  **hexan-2-ol** **hex-2-ene** **hex-1-ene**  **hexan-3-ol** **hex-2-ene** **hex-3-ene**	3 out of 5 of products/names		
(iii)	Elimination occurs when the –OH group is removed along with an H atom from a carbon atom adjacent to the carbon containing the –OH group.  Both reactions produce two different products because of the unsymmetrical nature of the alcohol molecule. For hexan-2-ol the H atom can be removed from a carbon atom containing two H atoms (carbon 3 in the chain) to give hex-2-ene or from a carbon atom containing 3 hydrogen atoms (carbon 1 in the chain) to give hex-1-ene. Hex-2-ene is the major product. This hydrogen atom is more likely to be removed from the carbon atom with the least H atoms (carbon 1 in the chain). For hexan-3-ol, both of the carbon atoms adjacent to the –OH bearing carbon have two H atoms so both products will be formed in equal amounts.	Recognises that the difference is related to the unsymmetrical nature of the alcohol Describes major and minor products of reaction one	Links the structure of the alcohols to the nature of the products Outlines how major or minor products are identified.	Links the structure of the alcohols to the nature of the products and to the different proportions of products
(b)	Hexane – (alkane), ethanol – alcohol, ethanoyl chloride – acid chloride, propanone – ketone, propanal – aldehyde.			

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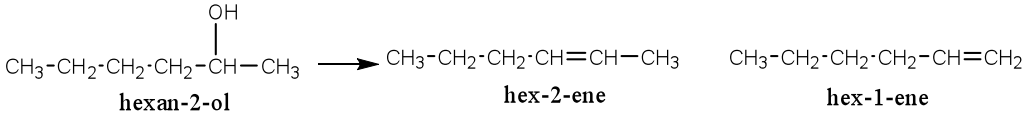
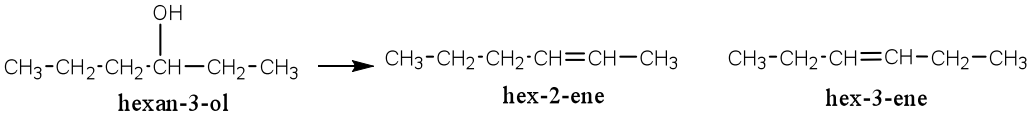
(ii)	 **hexan-2-ol** **hex-2-ene** **hex-1-ene**			
	 **hexan-3-ol** **hex-2-ene** **hex-3-ene**			
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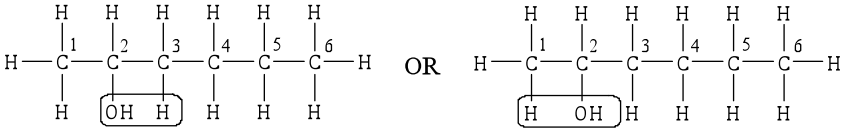
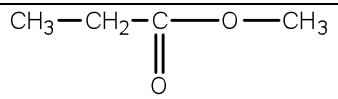
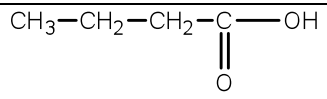
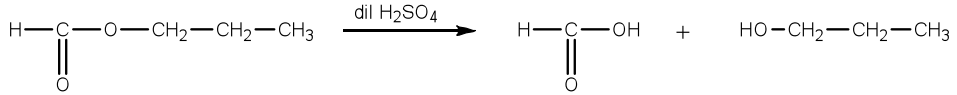
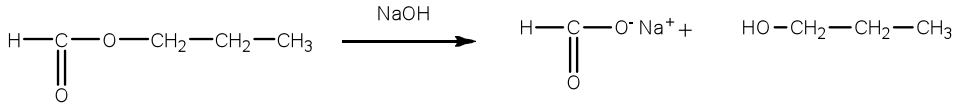
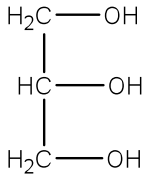
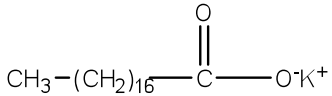
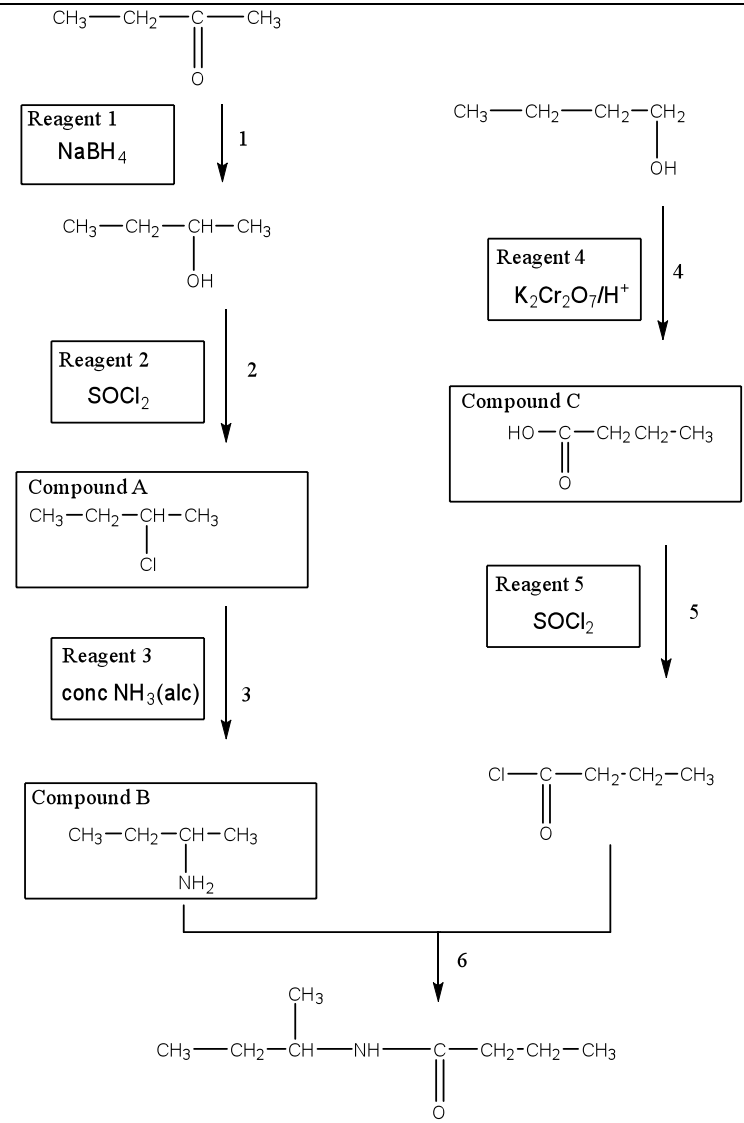
		Recognises that the difference is related to the unsymmetrical nature of the alcohol	Links the structure of the alcohols to the nature of the products	Links the structure of the alcohols to the nature of the products and to the different proportions of products
	Both reactions produce two different products because of the unsymmetrical nature of the alcohol molecule. For hexan-2-ol the H atom can be removed from a carbon atom containing two H atoms (carbon 3 in the chain) to give hex-2-ene or from a carbon atom containing 3 hydrogen atoms (carbon 1 in the chain) to give hex-1-ene. Hex-2-ene is the major product. This hydrogen atom is more likely to be removed from the carbon atom with the least H atoms (carbon 1 in the chain). For hexan-3-ol, both of the carbon atoms adjacent to the –OH bearing carbon have two H atoms so both products will be formed in equal amounts.	Describes major and minor products of reaction one	Outlines how major or minor products are identified.	
(b)	Hexane – (alkane), ethanol – alcohol, ethanoyl chloride – acid chloride, propanone – ketone, propanal – aldehyde.	4 functional groups identified		
	1. Add a small amount of water to a sample of each liquid (in a test tube) Three liquids will dissolve, one liquid will not mix and one will react to produce a gas Ethanoyl chloride reacts with water to produce a gas – the gas can be identified as acidic because it will turn moist blue litmus red. $CH_3COCl + H_2O \rightarrow CH_3COOH + HCl$ The liquid that does not mix is hexane. 2. To each of the three liquids that dissolved in water, add Tollens' reagent and heat. Propanal will produce a silver mirror $CH_3CH_2CHO \rightarrow CH_3CH_2COOH$ $(Ag^+ \rightarrow Ag)$	Recognises the species responsible one observed change	Valid method to identify three compounds	Valid method to distinguish all compounds and identifies reactants and organic products

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response or no relevant evidence.	1a	2a	4a	5a	3m	4m	2e with minor error / omission	2e.

THREE	Evidence	Achieved	Merit	Excellence
(a) (i)	 methyl propanoate  butanoic acid *Any ester and carboxylic acid with 4 carbons*	Either isomer with correct name or 2 structures	Both isomers with correct names	
(ii)	Acid hydrolysis results in the formation of an acid and alcohol. Base hydrolysis will result in the same alcohol and the salt of the acid  	Recognises one product from either acid or base reaction	Correct products for both acid and base reactions	Products of all hydrolysis reactions correct and production of soap discussed as hydrolysis reaction
(iii)	Hydrolysis of the ester group in base produces tri-alcohol (glycerol) and salt of the fatty acids - this is solid and is known as soap (names not needed)  glycerol = trialcohol  potassium salt of fatty acid = soap	Identifies hydrolysis OR one of saponification products	Both saponification products .	
(b) (i)				

(ii)	 Reduction reaction: 1 Oxidation reaction: 4 Substitution reaction: 2, 3 or 5	4 of 8 reagents /products correct 2 reactions correctly identified	6 of reagents/products correct	All of reaction scheme completed

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

Overall:

	Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
Score range	0 – 8	9 - 14	15 - 19	20 – 24