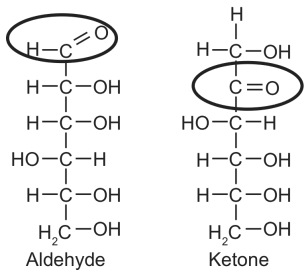
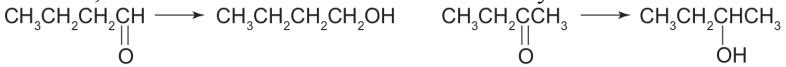
CHEMISTRY AS3.5 NZIC Assessment Schedule – 2013

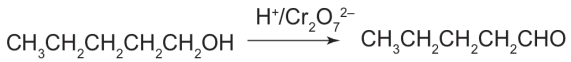
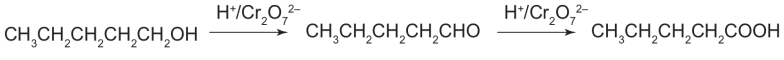
Chemistry: Demonstrate understanding of the properties of organic compounds. (91391)

While the writers of this assessment have worked to compile a resource that meets NCEA requirements, it has no official status and teachers may wish to adjust questions and the assessment schedule as they see fit.

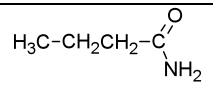
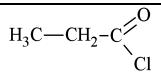
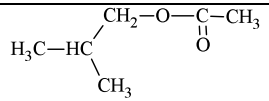
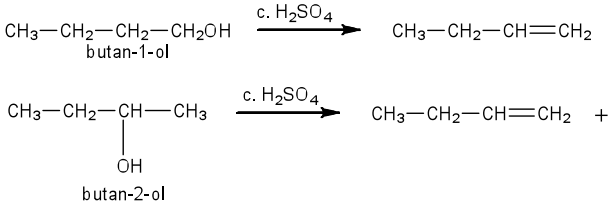
Assessment Criteria

Achievement	Achievement with Merit	Achievement with Excellence
• *Demonstrate understanding* of the properties of organic compounds.	• *Demonstrate in-depth understanding* of the properties of organic compounds.	• *Demonstrate comprehensive understanding* of the properties of organic compounds.

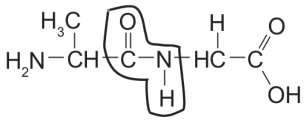
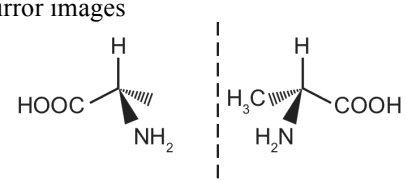
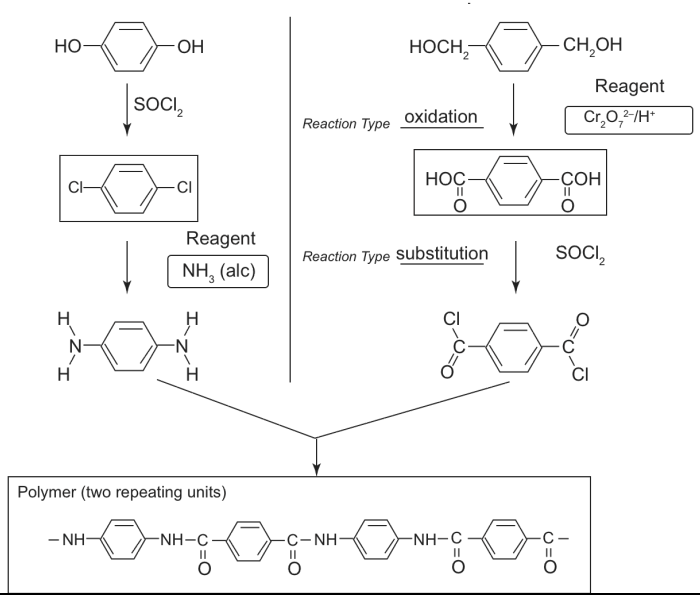
Question 1 Evidence	Achieved	Merit	Excellence
(a) (i)  	• In (a) (i) both aldehyde and ketone groups circled		
(ii) With an oxidant an aldehydes will be oxidised to a carboxylic acid, while ketones do not react. Reactants and expected changes: **Heat with acidified $Cr_2O_7^{2-}$:** colour change from orange to green. **Heat with acidified MnO_4^-:** colour change from purple to colourless **Benedict's test:** warm with Benedict's solution. Colour change from blue to brick red. **Fehling's Test:** Warm with Fehling's solution (a mixture of Fehling's A and Fehling's B solutions). Colour change from blue to brick red. **Tollen's Test:** Add Tollens reagent (silver nitrate and dilute ammonia) and heat. With aldehyde a silver metal "mirror" forms	• In (a) (ii) TWO of: > reactants required > conditions needed > expected observations	• In (a) (ii) writes a procedure to distinguish aldehyde and ketone.	• In (b) compares the reactions in terms of the reactants and whether a 1° or 2° alcohol is formed
(b)Butanal, an aldehyde can be reduced to a primary alcohol, butan-1-ol, while butanone, a ketone, will be reduced to butan-2-ol a secondary alcohol 	In (b) recognises reduction reaction OR alcohol product	• In (b) recognises reduction reaction AND alcohol products	AND

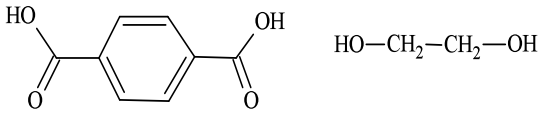
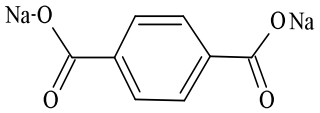
(c) If a mix of $Cr_2O_7^{2-}$ solution and pentan-1-ol is slowly fed from a separation funnel into hot dilute H_2SO_4, using equipment (i) (a flask connected to a Liebig condenser) ,the aldehyde formed is then quickly vapourised before it is oxidised into a carboxylic acid. It is then condensed so it runs down into the collection vessel.  $CH_3CH_2CH_2CH_2CH_2OH \xrightarrow{H^+/Cr_2O_7^{2-}} CH_3CH_2CH_2CH_2CHO$ If pentan-1-ol is heated with an oxidising agent (e.g. $H^+/ Cr_2O_7^{2-}$) under reflux using equipment ii (a bulb flask attached to a vertical Liebig condenser), pentanoic acid is obtained. The reaction is slower than the conversion to an aldehyde and to ensure conversion of all the alcohol into carboxylic acid, reflux is required to return any unreacted alcohol back into the reaction mixture so that it can react and form the acid.  $CH_3CH_2CH_2CH_2CH_2OH \xrightarrow{H^+/Cr_2O_7^{2-}} CH_3CH_2CH_2CH_2CHO \xrightarrow{H^+/Cr_2O_7^{2-}} CH_3CH_2CH_2CH_2COOH$	• In (c) chooses one correct set of equipment linked to reaction required	• In(c) reasons for using the different equipment given In (c) a description given of how one set of equipment allows the reactions to proceed to their desired product.	In (c) links the equipment to the chemistry of the reactants and products.

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

Question 2	Evidence	Achieved	Merit	Excellence
(a)		• In (a) 2 of the 3 names correct.	• In (a) all names correct	• In (b) two named structures AND
	Compound / **IUPAC systematic name**  **butanamide**  **propanoyl chloride**  **2- methylpropyl ethanoate**		• In (b) two named structures are correct	• In (c) (i) and (ii) a full discussion comparing the types of reaction including reaction products and reasons for differences
(b) Any ester with 6 carbons. Any 6 carbon carboxylic acid.		• In (b) one named structure or two structures are correct		
(c) (i) Butan-1-ol reacts with concentrated H_2SO_4 to form but-1-ene and water. This is an elimination reaction. Since this is a primary alcohol with the –OH group at the end of the carbon chain there is only one possible product. Butan-2-ol is an unsymmetrical secondary alcohol so there are two ways the H_2O can be eliminated forming but-1-ene and but-2-ene. But-2-ene is the major product as the H eliminated is from the C with the least H atoms.		• In (c) one type of reaction is correct	• In (c) (i) recognises elimination reaction and the different products formed but reasons not adequate	
		• In (c) (i) or (ii) reaction product/products are given • In (c) (i) Recognises major and minor products	• In (c) (ii) one reaction with NH_3 is correct n with products and reason for one reaction OR both reactions correctly identified but discussion incomplete.	
(ii) When ammonia reacts with propanoic acid, an acid-base reaction occurs A proton is transferred from the –COOH group to the NH_3.to form a salt, ammonium propanoate ($CH_3\ CH_2COONH_4$) (If heat is applied a substitution reaction occurs resulting in an amide). $CH_3\ CH_2COOH + NH_3 \rightarrow CH_3\ CH_2COONH_4$ When ammonia reacts with propanoyl chloride, a substitution reaction occurs where NH_2 is substituted for the chlorine forming an amide (propanamide) $CH_3\ CH_2COCl + 2NH_3 \rightarrow CH_3\ CH_2CONH_2 + NH_4Cl$				

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

Question 3	Evidence	Achieved	Merit	Excellence
(a) (i) 		• In (a) a correct peptide drawn OR peptide link correctly circled.	• In (a) a correct peptide drawn with link correctly circled AND recognises why amino acids can form polymers	
(ii) Amino acids can form polymers because at each end of the molecule is a functional group that can react with a functional group from neighbouring molecules.		• In (a) (ii) identifies having both functional groups on one molecule as being necessary		
(b) To be able to form enantiomers a molecule must have a chiral atom – one to which four different groups are attached. This enables the formation of molecules which are non-superimposable mirror images of each other.		• In (b) Links enantiomers to a chiral C (words or diagram)		
• Glycine does not have a chiral carbon atom as the second carbon has only 3 different groups attached Alanine has a chiral carbon. The second carbon atom has a hydrogen atom, a methyl group, a carboxylic acid group and an amino group. Hence it can form non-superinposable mirror images		• In (b) identifies differences stereochemistry of the amino acids	• In (b) explains why alanine can form enantiomers and glycine cannot	• In (b) compares the structures of alanine and glycine and links them to the ability to form enantiomers (with diagrams)
(c)		In (c) any 3 requirements of the scheme correct. OR Polymer drawn correctly	In (c) scheme completed with one error allowed (includes polymer)	In (c) completes the reaction synthesis pathway

(d) Under acidic hydrolysis conditions we get the diol and the dicarboxylic acid being formed when the ester bonds are broken. A water molecule is also formed.  In basic hydrolysis conditions the carboxylic group would be ionised and the sodium salt of the acid is formed. 	• In (d) states the different sets of products for acid and for basic hydrolysis	• In (d) compares the similarities of the acid and base hydrolysis products or contrasts their differences	• In (d) compares the similarities of the acid and base hydrolysis products and contrast their differences and link them to the conditions of the hydrolysis.

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

Judgement Statement

	Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
Score range	0 – 6	7 – 13	14 – 18	19 – 24