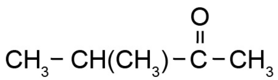
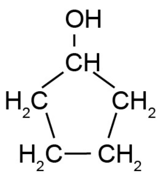
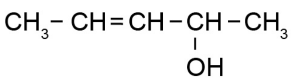
Assessment Schedule – 2019

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

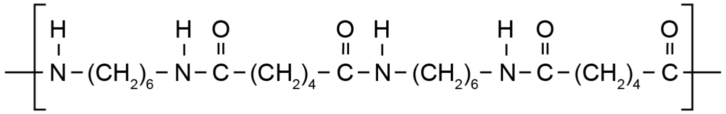
Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)(i)	4-chloropentanal $CH_3CH_2CH_2CH_2CH_2COOCH_2CH_3$ 3-methylbutanamide	TWO correct.		
(ii)	$CH_3–CH_2–CH_2OH$ The aldehyde can be oxidised to the carboxylic acid so it needs to be removed from the reaction mixture before this happens. Distillation separates liquids with different boiling points so removes the aldehyde before it oxidises to a carboxylic acid as it has a lower boiling point than the alcohol.	Correct structural formula of propan-1-ol. OR Correct statement related to oxidation or boiling point of the aldehyde.	Correct structural formula of propan-1-ol AND an explanation of why and how distillation is used.	
(b)(i)	Add bromine water. The propene undergoes an addition reaction to form 1,2-dibromopropane, $CH_2BrCHBrCH_3$. The bromine water will change from orange to colourless. The propan-1-ol will not react. OR Add acidified potassium dichromate solution and heat. The propan-1-ol will undergo an oxidation reaction to form propanoic acid, CH_3CH_2COOH (or propanal). The colour change will be orange to green/blue. The propene will not react.	TWO correct reagents OR observations. TWO correct reaction types.	TWO pairs of compounds distinguished with reagents, observations and reaction type.	ALL pairs of compounds distinguished with reagents, conditions, observations, reaction type, and structural formulae of organic products.
(ii)	Add Tollens' reagent and heat. The butanal will form a silver mirror, since the butanal is oxidised to butanoic acid, $CH_3CH_2CH_2COOH$. OR Add Benedict's (Fehlings) reagent and heat. The butanal will form an orange-red solid, since the butanal is oxidised to butanoic acid, $CH_3CH_2CH_2COOH$. In both cases, there is no reaction with the butan-1-ol.			
(iii)	Add water. The ethanoyl chloride will undergo a substitution reaction and react vigorously to produce steamy fumes (that turn damp blue litmus paper red); the organic product is CH_3COOH. The ethyl pentanoate will be insoluble / no reaction.			
(c)	**W:** $Cl – CH_2 – CH_2 – CH_2 – COCl$ **X:** $H_2N – CH_2 – CH_2 – CH_2 – CONH_2$ **Y:** $^+H_3N – CH_2 – CH_2 – CH_2 – COOH$	ONE structure correct.	TWO structures correct.	THREE structures correct.

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

Q	Evidence	Achievement	Merit	Excellence
TWO (a)(i)		Recognises tetrahedral arrangement of correct atoms / groups about asymmetric C atom.	Two correct structures of 2-chlorobutane. AND	
(ii)	The enantiomers can be distinguished based upon 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.	Explains enantiomers can rotate (plane) polarised light in opposite directions.	
(b)	**Product A:** $CH_3CH_2CH{=}CH_2$ (but-1-ene) **Product B:** $CH_3CH_2CH_2CH_2Cl$ (1-chlorobutane) **Product C:** $CH_3CH_2CH_2CH_2OH$ (butan-1-ol) **Product D:** $CH_3CH_2CH_2COCl$ (butanoyl chloride) **Reagent 1:** NH_3 alc/conc **Reagent 2:** $Cr_2O_7^{2-}$/ H^+ or MnO_4^-/ H^+ **Reagent 3:** $SOCl_2$	THREE correct.	FIVE correct.	ALL correct.
(c)(i)	$CH_3-CH_2-CH_2-CH_2-CHO$	ONE structure correct.	THREE structures correct.	ALL structures correct.
(ii)	 OR Branched alkene with alcohol functional group (see appendix)			
(iii)				
(iv)				

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)(i) (ii)	 Nylon 6,6 is referred to as a condensation polymer because small organic molecules/ monomers join together to make a larger organic molecule / polymer, with the release of a small molecule, H_2O (for each amide link formed).	Shows amide linkage in polymer chain. One correct statement about condensation polymerisation.	Correctly draws TWO repeating units, AND explains how a condensation polymer forms.	
(b)(i) (ii)	Circle around – COO – A hydrolysis reaction uses water to split a large organic molecule into smaller organic molecules. Hydrolysis occurs in both acidic and basic conditions (using dilute acid or base). Both acidic and basic hydrolysis require heat under reflux. Both hydrolysis reactions produce the alcohol, glycerol. However, basic hydrolysis will produce the salt of the carboxylic acid, whereas acidic hydrolysis will produce the carboxylic acid. Products from acidic hydrolysis: $CH_2(OH) – CH(OH) – CH_2(OH)$ $3CH_3 – (CH_2)_{14} – COOH$ Products from basic hydrolysis: $CH_2(OH) – CH(OH) – CH_2(OH)$ $3CH_3 – (CH_2)_{14} – COO^–$	Correctly circles ester group. Describes the hydrolysis reaction. One correct product.	Links acidic OR basic hydrolysis reaction to correct products with structural formulae.	Compares and contrasts acidic and basic hydrolysis, including ALL correct structural formulae of products.
(c)	**Step 1:** butanone to butan-2-ol using $NaBH_4$. $CH_3 – CH_2 – CH(OH) – CH_3$ **Step 2:** butan-2-ol to but-2-ene using conc. H_2SO_4 and heat. $CH_3 – CH = CH – CH_3$ **Step 3:** but-2-ene to butan-2,3-diol using $KMnO_4$ (neutral conditions). $CH_3 – CH(OH) – CH(OH) – CH_3$ **Step 4:** butan-2,3-diol to butan-2,3-dione using acidified potassium dichromate and heat. OR see appendix	Recognises TWO appropriate reagents.	TWO steps correct, including structural formulae and reagents.	A procedure to convert butanone into butan-2,3-dione, including all structural formulae.

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

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 13	14 – 19	20 – 24

Appendix

Question Two (c)(ii)
Branched alkenes with alcohol group include:
$CH_2 – CH = CH(CH_3)CH_2OH$
$CH_3 – CH = C(CH_3) – CH_2OH$
$CH_3 – C(CH_3) = CH – CH_2OH$
$CH_3 – C(CH_3) = COH – CH_3$
$CH_3 – COH = C(CH_3) – CH_3$

Question Three (c)
B:
Step 1: butanone to butan-2-ol using $NaBH_4$.

$CH_3 – CH_2 – CH(OH) – CH_3$

Step 2: butan-2-ol to but-2-ene using conc. H_2SO_4 and heat.

$CH_3 – CH = CH – CH_3$

Step 3: but-2-ene to 2,3-dihalobutane using X_2

$CH_3 – CHX – CHX – CH_3$

Step 4: 2,3-dihalobutane to butan-2,3-diol using KOH(*aq*)
$CH_3 – CH(OH) – CH(OH) – CH_3$

Step 5: butan-2,3-diol to butan-2,3-dione using acidified potassium dichromate and heat.

C:
Step 1: butanone to 3-bromobutanone using Br_2 and UV light.

$CH_3 – CHBr – CO – CH_3$

Step 2: 3-bromobutanone to 3-hydroxybutanone using KOH(*aq*)

$CH_3 – CHOH- CO – CH_3$

Step 3: 3-hydroxybutanone to butan-2,3-dione using acidified potassium dichromate and heat.