

**Assessment Schedule – 2008****Chemistry: Describe aspects of organic chemistry (90698)****Evidence Statement**

Q	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
ONE (a)	Propanamide Hexan-3-one Methylpropanoate 3,3-dimethylbutanoic acid	THREE names correct. OR all identified in terms of chain length and functional group but remove missing or incorrect numbers.	All correct.	
(b)	$\begin{array}{c} \text{NH}_2 \\   \\ \text{H}_3\text{C}-\text{CH}_2-\text{CH}-\text{CH}_2-\text{CH}_3 \end{array}$	THREE structural formulae correct.		
	$\begin{array}{c} \text{O} \\    \\ \text{H}_3\text{C}-\text{C}-\text{Cl} \end{array}$			
	$\begin{array}{c} \text{OH} \quad \text{Cl} \\   \quad   \\ \text{H}_2\text{C}-\text{CH}-\text{CH}_3 \end{array}$	$\begin{array}{c} \text{O} \\    \\ \text{HC}-\text{CH}-\text{CH}_2-\text{CH}_3 \\   \\ \text{CH}_3 \end{array}$		
TWO (a)	$\begin{array}{c} \text{H}_3\text{C} \quad \quad \text{O} \quad \quad \text{CH}_3 \quad \text{O} \\   \quad \quad    \quad \quad   \quad    \\ \text{H}_3\text{C}-\text{CH}-\text{CH}-\text{C}-\text{NH}-\text{CH}-\text{C}-\text{OH} \\   \\ \text{NH}_2 \end{array}$ <p>or</p> $\begin{array}{c} \text{NH}_2 \quad \text{O} \quad \quad \text{O} \\   \quad    \quad \quad    \\ \text{H}_3\text{C}-\text{CH}-\text{C}-\text{NH}-\text{CH}-\text{C}-\text{OH} \\   \quad \quad   \\ \text{HC} \\ / \quad \backslash \\ \text{H}_3\text{C} \quad \text{CH}_3 \end{array}$	Amide linkage correctly drawn.	ONE complete dipeptide structure.	

(b)	<p>The amide linkage is hydrolysed with both acidic and basic hydrolysis.</p> <p>(i) Under acidic conditions the products would be:</p> <p><b>A.</b> <math>\text{HO}-\text{CH}_2-\overset{\text{NH}_3^+}{\underset{ }{\text{CH}}}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}</math>    <b>B.</b> <math>\text{H}_3\text{N}^+-\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}</math></p> <p>(ii) Under alkaline conditions, the products would be:</p> <p><b>C.</b> <math>\text{HO}-\text{CH}_2-\overset{\text{NH}_2}{\underset{ }{\text{CH}}}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}^-</math>    <b>D.</b> <math>\text{H}_2\text{N}-\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}^-</math></p>	Identifies amide linkage as bond hydrolysed. ONE correct hydrolysis product drawn under either acidic, basic or alternately the product under neutral conditions, ie accept $\text{COO}^-$ (or $\text{COONa}$ ) or $\text{COOH}$ and $\text{NH}_3^+$ or $\text{NH}_2$ .	Any TWO structures correct showing $\text{NH}_3^+$ on products of acidic hydrolysis and $\text{COONa}$ or $\text{COO}^-$ on products for alkaline hydrolysis.	Identifies both structures of acidic hydrolysis AND alkaline hydrolysis (with $\text{COONa}$ or $\text{COO}^-$ ).				
THREE (a)	<table><tr><td><math>\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\text{CH}_2\text{OH}</math></td><td><math>\text{H}_3\text{C}-\text{CH}_2-\underset{\text{OH}}{\text{CH}}-\text{CH}_3</math></td></tr><tr><td><math>\text{H}_3\text{C}-\underset{\text{OH}}{\overset{\text{CH}_3}{\text{C}}}-\text{CH}_3</math></td><td><math>\text{H}_3\text{C}-\underset{\text{CH}_3}{\text{CH}}-\text{CH}_2-\text{OH}</math></td></tr></table>	$\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\text{CH}_2\text{OH}$	$\text{H}_3\text{C}-\text{CH}_2-\underset{\text{OH}}{\text{CH}}-\text{CH}_3$	$\text{H}_3\text{C}-\underset{\text{OH}}{\overset{\text{CH}_3}{\text{C}}}-\text{CH}_3$	$\text{H}_3\text{C}-\underset{\text{CH}_3}{\text{CH}}-\text{CH}_2-\text{OH}$	THREE correct structures.	FOUR correct structures. (no incorrect or duplicate structures).	
$\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\text{CH}_2\text{OH}$	$\text{H}_3\text{C}-\text{CH}_2-\underset{\text{OH}}{\text{CH}}-\text{CH}_3$							
$\text{H}_3\text{C}-\underset{\text{OH}}{\overset{\text{CH}_3}{\text{C}}}-\text{CH}_3$	$\text{H}_3\text{C}-\underset{\text{CH}_3}{\text{CH}}-\text{CH}_2-\text{OH}$							
(b) (i)	Butan-2-ol identified.	EITHER (i) Correct selection of only the butan-2-ol. OR (ii) correct explanation.	Correct selection of optical isomer and explanation.					
(ii)	Optical isomers rotate plane polarised light in opposite directions.							

(c)(i)	Aldehyde (propanal) is obtained by heating a mixture of propan-1-ol with acidified (potassium dichromate) solution or (acidified) permanganate solution. Propanal can be removed from the solution as it forms, using distillation, as the aldehyde has a lower boiling point than propan-1-ol and the carboxylic acid. Carboxylic acid (propanoic acid) is obtained by reacting a mixture of propan-1-ol with acidified potassium dichromate solution (under reflux conditions) until all of the reactant has been converted to propanoic acid.	Identifies TWO products of oxidation (as aldehyde and carboxylic acid or as propanal and propanoic acid) AND correct reagent for oxidation OR using chemical tests to positively identify TWO of the organic species and links reactions to observations.	Identifies TWO products of oxidation and correct reagent for oxidation plus correct description of how to obtain two separate products OR distinguishes between the products and the original alcohol using chemical tests – linking observations to reactions.	Identifies TWO products of oxidation AND correct reagent for oxidation AND correctly describes how to obtain two separate products AND how to distinguish between the products and the original alcohol, linking observations to reactions.
(ii)	Propanoic acid can be identified as it turns damp blue litmus paper red or produces a gas with a metal carbonate or bicarbonate. Neither propan-1-ol nor propanal change the colour of litmus paper or react with the carbonate or bicarbonate. Propanal will form a brick-red ppt with Benedict's or Fehling solutions or a silver mirror with Tollens' reagent, but propan-1-ol will not. OR use acidified dichromate or acidified permanganate which will not react with the acid but will oxidise both the alcohol and aldehyde and turn the orange $\text{Cr}_2\text{O}_7^{2-}$ green or purple $\text{MnO}_4^-$ to colourless. OR In reverse identify aldehyde first (as above) then use litmus or $\text{Cr}_2\text{O}_7^{2-}/\text{H}^+$ or $\text{MnO}_4^-/\text{H}^+$ to identify acid or alcohol respectively.			
FOUR	(Methanoic acid + 2-methylpropan-1-ol $\rightleftharpoons$ 2-methylpropylmethanoate + water) $\text{HCOOH} + \text{HOCH}_2\text{CH}(\text{CH}_3)_2 \rightleftharpoons \text{HCOOCH}_2\text{CH}(\text{CH}_3)_2 + \text{H}_2\text{O}$ Sulfuric acid is added as a catalyst and/or a dehydrating agent to push the equilibrium reaction towards the product ester by removing the water molecule. Potassium carbonate is added after completing the reaction to neutralise the excess acid. Refluxing is used to heat an organic reaction without losing volatile organic reactants or products. Distillation is used to separate the product from any remaining reactants. It works because all the organic molecules will have different boiling points.	Describes the use of TWO reagents OR limited explanation of refluxing and distillation OR writes equation (not words) for reaction that shows the structure of the 2 reactants OR explanation of one process and use of one reagent.	EITHER Chemical equation showing structures of reactants and the ester AND any two explanations correct in relation to the use of the reagents or the processes (distillation and refluxing) OR the two processes (distillation and refluxing) and the correct use of the 2 reagents.	Appropriate chemical equation including $\text{H}_2\text{O}$ as a product. Discusses why the two reagents are used and why refluxing and distillation are used.

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Reagent	Formula
1	$\text{PCl}_3$ , or $\text{PCl}_5$ , or $\text{SOCl}_2$ , or $\text{HCl}$
2	$\text{NH}_3$
3	$\text{Cr}_2\text{O}_7^{2-}/\text{H}^+$ or $\text{MnO}_4^-/\text{H}^+$
4	$\text{PCl}_3$ , or $\text{PCl}_5$ , or $\text{SOCl}_2$
5	$\text{CH}_3\text{NH}_2$

Product	Name or formula
1	$\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{Cl}$
2	$\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\text{C}\begin{smallmatrix} \text{O} \\ // \\ \text{OH} \end{smallmatrix}$
3	$\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\text{C}\begin{smallmatrix} \text{O} \\ // \\ \text{Cl} \end{smallmatrix}$

OR

Reagent	Formula
1	$\text{PCl}_3$ , or $\text{PCl}_5$ , or $\text{SOCl}_2$ , or conc $\text{HCl}$
2	$\text{NH}_3$
3	$\text{Cr}_2\text{O}_7^{2-}/\text{H}^+$ or $\text{MnO}_4^-/\text{H}^+$
4	$\text{Cr}_2\text{O}_7^{2-}/\text{H}^+$ or $\text{MnO}_4^-/\text{H}^+$
5	$\text{CH}_3\text{NH}_2$

Product	Name or formula
1	$\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{Cl}$
2	$\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\text{C}\begin{smallmatrix} \text{O} \\ // \\ \text{OH} \end{smallmatrix}$
3	$\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\text{C}\begin{smallmatrix} \text{O} \\ // \\ \text{H} \end{smallmatrix}$

In the blank boxes provided:

EITHER

Two correct products and the reagents that form them (may omit  $\text{H}^+$ )

OR

three consecutive boxes correct.

In the blank boxes provided:

EITHER

Two series of 3 consecutive boxes correct

OR

all correct except for one of the reagents.

Scheme correct.

**Judgement Statement**

<b>Achievement</b>	<b>Achievement with Merit</b>	<b>Achievement with Excellence</b>
<p>Total of FIVE opportunities answered at Achievement level or higher.</p> <p><math>5 \times A</math></p>	<p>Total of at least SIX opportunities answered with FOUR at Merit level or higher.</p> <p><math>4 \times M + 2 \times A</math></p>	<p>Total of at least SEVEN opportunities answered with TWO at Excellence level and THREE at Merit level or higher.</p> <p><math>2 \times E + 3 \times M + 2 \times A</math></p>