NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Level 2, 2003

Chemistry: Describe the structural formulae and reactions of compounds containing selected organic functional groups (90309)

National Statistics

Assessment Report

Assessment Schedule

Chemistry: Describe the structural formulae and reactions of compounds containing selected organic functional groups (90309)

National Statistics

Number of Results	Percentage achieved			
	Not Achieved	Achieved	Merit	Excellence
8,744	39.8%	31.3%	18.8%	10.1%

Assessment Report

General Comments

Every candidate for a National Certificate of Educational Achievement examination paper is expected to:

- read the question and do what the question asks
- allow adequate time to complete answers
- be accurate: check and/or proofread
- use appropriate technical terms
- bring the correct equipment
- write and/or draw clearly
- use pen if work is to be eligible for reconsideration.

Generally candidates performed well across parts of this paper.

The following key ideas relating to this achievement standard should be considered and addressed.

1 The ability to accurately name and draw organic structures is an essential requirement of this standard. While simple spelling mistakes can be ignored in descriptive sentences, spelling is critical in organic nomenclature because of the significant differences between ethane and ethene. Also important is the -an- in names such as butan-2-ol. The number 1 is needed in a formula such as 1-butanol or butan-1-ol, as well as the hydrogen atoms in organic structures.

2 Candidates need to ensure their answers address key words in the questions. For example, in Q1a the **name** of the alcohol was often provided instead of the requested **type,** and in Q1(b) a specific reactant was often given rather than the type of reaction involved, suggesting confusion between the words reaction and reactant. Similarly, the use of the word **contrast** in Q1d and the use of the phrase **describe a test** in Q1g and Q4d frequently resulted in reactions rather than distinguishing tests being applied.

3 Candidates need to be able to distinguish between terms such as saturated and unsaturated, and addition and substitution, and to clearly express what is meant by concepts such as structural isomerism.

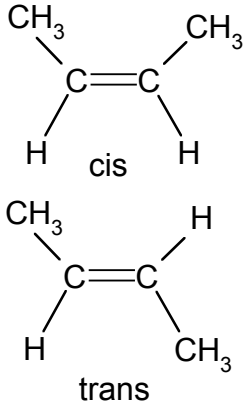
4 Conceptual areas, which may not have been included in previous Year 12 courses, of concern were:
   (i) the lack of awareness of unsymmetrical addition across a double bond
   (ii) the concept of elimination and polymerisation reactions
   (iii) confusion with the concept of cis/trans isomerism
   (iv) lack of familiarity with the classification of alcohols as primary, secondary or tertiary.

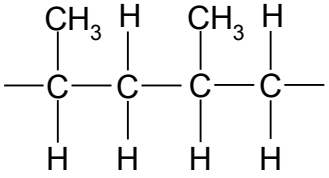
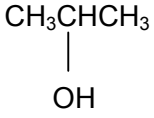
5 Candidates need to be able to suggest methods of distinguishing between different functional groups. Often they knew what should be added but could not provide an accurate description of the expected observations suggesting that they may have never actually carried out such experiments. Other candidates mismatched their test and observation – for example colour changes expected for permanganate were given when the use of dichromate was specified and vice versa.

Assessment Schedule

Chemistry: Describe the structural formulae and reactions of compounds containing selected organic functional groups (90309)

Evidence Statement

Question	Evidence	Evidence contributing to Achievement	Evidence contributing to Achievement with Merit	Evidence contributing to Achievement with Excellence
ONE (a)	Primary (alcohol)/butan-**1**-ol	Correct identification		
(b)	Oxidation/redox	Implication that oxidation occurs.		
(c)	Fizzing/bubbling/CO_2(gas) given off	Recognition that a gas is produced.		
(d)	Bromine water rapidly reacts with the alkene B and is decolourised. This is an addition reaction and forms 2,3-dibromobutane. The alkane D only slowly decolourises the bromine in the presence of sunlight. The reaction is a substitution reaction and forms a bromobutane and HBr after the reaction with one molecule of Br_2.	Answer includes at least one clear comparison related to rate of colour change, presence of UV, reaction type, or product name/formula.	Answer includes at least two clear comparisons related to rate of colour change, presence of UV, reaction type, or product name/formula.	Answer includes at least three clear comparisons related to rate of colour change , presence of UV, reaction type, or product name/formula. Appropriate equations are also included.
(e)	Structural isomers have the same molecular formula but different structural formula/ structure/arrangement. Examples include C & E, B & F.	Identifies a pair of structural isomers **or** gives explanation with no example.	Gives an appropriate explanation **with** relevant example.	
(f)		Both isomers drawn clearly recognise that for cis the CH_3 groups are on the same side of the double bond whereas in trans isomer the CH_3 groups are on opposite sides of the double bond.		

Question	Evidence	Evidence contributing to Achievement	Evidence contributing to Achievement with Merit	Evidence contributing to Achievement with Excellence
(g)	Add water – A and E dissolve Add blue litmus – E turns it red **OR** add E to sodium carbonate/reactive metal and bubbles of gas are produced **OR** add $K_2Cr_2O_7/H^+$ – A will change it from orange to green C will not dissolve in water	One product identified with appropriate explanation/ observations.	Two products identified with appropriate explanation/ observations.	All three products identified with explanations/ observations.
(h)(i)	(Carboxylic) Acid/carboxyl Ester Alcohol/hydroxy/hydroxyl Alkene	3 functional groups correctly identified.		
(ii)	Propanoic acid Methyl ethanoate (2-)Methylpropan-2-ol 5-methylhex-1-ene	3 names correct (ignore numbers or lack of them as emphasis is on ability to identify functional groups and chain length).	3 names correct including numbers.	
TWO (a)		Diagram clearly shows methyl groups on every second carbon.		
(b)	(i) $CH_3CH_2CH_3$ (ii) $CH_3CH_2CH_2OH$ and  (iii)*$CH_3CH(OH)CH_3$	Any two products correctly identified.	All three products correct and major product correctly identified.	

Question	Evidence	Evidence contributing to Achievement	Evidence contributing to Achievement with Merit	Evidence contributing to Achievement with Excellence
THREE	X = $CH_3CH_2CH_2CH_2OH$ butan-1-ol Y = $CH_3CH_2CH_2COOH$ butanoic acid Z = $CH_3(CH_2)_2COO(CH_2)_3CH_3$ butylbutanoate W = $CH_3CH_2CH{=}CH_2$ but-1-ene V = $CH_3CH_2CH_2CH_2Cl$ 1-chlorobutane V' = $CH_3CH_2CHClCH_3$ 2-chlorobutane Note: V and V' may be reversed.	3 compounds are correctly identified with structural formulae. 3 compounds correctly named (not necessarily the correct product).	4 compounds are correctly identified with structural formulae. Four compounds correctly named.	5 compounds are correctly identified with structural formulae and are named correctly.
FOUR (a)	Any ester group identified	Only the COO group is circled		
(b)	Alcohol/hydroxy/hydroxyl	propane-1,2,3-triol /glycerol	Alcohol or equivalent group.	
(c)	Some carbon–carbon bonds are not single (double or triple).	Indication of multiple bonds **or** that not all carbons have as many atoms bonded to them as possible.		
(d)	Add bromine solution to the fat drop by drop until the orange colour stays. Count the number of drops added. The more drops taken the more unsaturated the fat.	Answer identifies that when the bromine is added it is decolourised.	Achievement plus link made between the number of drops and degree of unsaturation.	

Judgement Statement

Judgement statements (formerly referred to as sufficiency statements) help students understand how their overall results for each standard were arrived at.

Achievement	Achievement with Merit	Achievement with Excellence
8 of the Achievement opportunities	5 of the Merit opportunities ***plus*** 3 Achievement opportunities or better	2 of the Excellence opportunities ***plus*** 3 Merit opportunities ***plus*** 3 Achievement opportunities or better