Assessment Schedule – 2022 Final

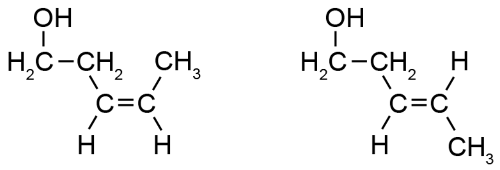
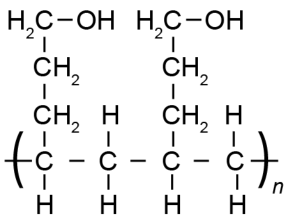
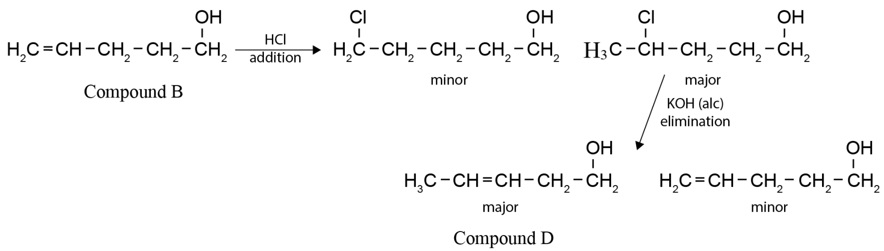
Chemistry: Demonstrate understanding of the properties of selected organic compounds (91165)

Evidence

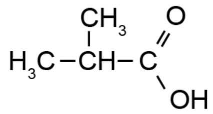
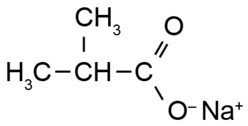
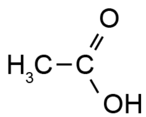
Q	Evidence	Achievement	Merit	Excellence
ONE (a)(i)	**Primary alcohol**: B or D; **Secondary alcohol**: A or C; **Tertiary alcohol**: E	• 2 / 3 correct.	• 2 / 3 correct.	
(ii)	This alcohol is classified as secondary because the carbon atom that is attached to the OH functional group is bonded to two other carbon atoms.	OR Correct explanation.	AND Correct explanation.	
(iii)	Constitutional isomerism indicated. *Constitutional isomers* are compounds with the same molecular formula, but different structural formulas. Both compounds have the molecular formula of $C_5H_{10}O$, but they have a different connectivity of atoms. Compound B is an alkene while Compound C has a cyclic structure.	• Correct choice and definition. OR Correctly ruled out geometric isomerism	• Correct type of isomerism with explanation linked to structures.	
(b)	Compound C reacting with bromine water will be a slow reaction, requiring UV light as a catalyst. This is a substitution reaction, where the H on one carbon is substituted by a Br atom. The bromine water will decolourise from a red brown / orange / brown / yellow colour. When the other compounds react with bromine water, it is a fast reaction. This is an addition reaction, where the double bond is broken, and two Br atoms are added. The bromine water decolourises from a red brown / orange / brown / yellow colour.	• Identifies the two types of reaction occurring. • States the correct colour change.	• Explains the type of reaction linked to observations for Compound C or one of the other compounds.	• Full explanation of reaction linked to observations for Compound C or the other compounds and attempts a comparison between the two

(c)(i)	From Compound F: $CH_3-CH=CH-CH_2-CH_3$ — Major product $CH_2=CH-CH_2-CH_2-CH_3$ — Minor product From Compound G: $CH_3-CH=CH-CH_2-CH_3$	• Correct structure(s) for product(s) from ONE compound (major / minor can be incorrectly assigned).	• Explains major and minor products but missing aspects of explanation. AND Correct structures	• Full explanation of how to identify the major and minor products. AND Correct structures.
(ii)	Compound F is asymmetric about the alcohol group. This means two different products form, depending on which neighbouring carbon the hydrogen atom is eliminated from. The major product is formed when the OH group is eliminated, along with a hydrogen atom from the neighbouring carbon bearing the least number of hydrogen atoms. This is C3 as it is only bonded to 2H's while C1 is bonded to 3 H's. This produces pent-2-ene as the major product and pent-1-ene as the minor product. Compound G is a symmetrical alcohol, meaning only one product is formed, regardless of which neighbouring carbon the hydrogen atom is eliminated from, resulting in pent-2-ene.	• States there are two ways that H_2O can be eliminated.	• Links symmetry or asymmetry of alcohol to number of reaction products.	• Full explanation of why a different number of products are formed.

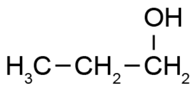
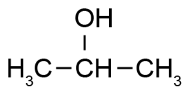
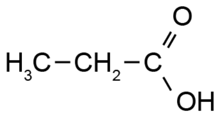
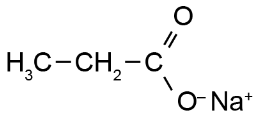
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	1a	2a	3a	4a	3m	4m	2e (minor error/omission)	2e

Q	Evidence	Achievement	Merit	Excellence
TWO (a)(i)	Compound D	• Correct compound and isomers.		
(ii)	 *cis* *trans*			
(iii)	Compound D forms cis / trans isomers, as it has both requirements for geometric isomerism. It contains a C=C double bond, which prevents rotation of atoms about the bond. Compound A also has this. However, the second requirement is that each carbon of the double bond is bonded to two different atoms or groups. Compound A doesn't meet this requirement, as one of the carbons has two hydrogen atoms attached. In Compound D, one of the carbons of the double bond has a hydrogen atom and a methyl group, while the other has a hydrogen atom and a CH_2CH_2OH group, which can be arranged differently in space, forming geometric isomers.	• States the two requirements for geometric isomerism. • Identifies double bond restricts rotation OR Identifies two groups.	• Explains why the double bond is required for geometric isomerism • Explains why each C on the double bond must have two different atoms or groups on them.	• Justifies why Compound D forms geometric isomers while compound A doesn't.
(b)(i)		• Correct polymer.		
(ii)		• Identifies that atoms needs to be added but uses incorrect reagent. OR Both reaction types identified. • Major and minor products identified for one step (can have error in reagent).	• One step fully correct with major and minor products identified. OR Both reagents in correct order.	• Correct process to form compound D with major and minor products and reaction types fully identified.

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

Q	Evidence	Achievement	Merit	Excellence
THREE (a)(i)	**I** H_3C-CH_2-OH **J** propan-2-amine / 2-aminopropane **K**  **L** 2,3-dimethylbutane	• 2 / 4 correct.		
(ii)	Add sodium carbonate chips to all samples. The sample that bubbles is Compound K (methylpropanoic acid), as carboxylic acids undergo acid-base / acid-carbonate / neutralisation reactions with carbonates. The product of this reaction is sodium methylpropanoate.  Add aqueous acidified potassium dichromate to all remaining samples. The one that turns the dichromate from orange to green is Compound I (ethanol), as primary alcohols undergo oxidation / redox reactions with acidified dichromate. The product of this reaction is ethanoic acid.  Compound L (2,3-dimethylbutane) will not dissolve in the aqueous solution as it is an alkane/non-polar and will form two layers. Compound J (propan-2-amine) is an amine, so it will dissolve in the aqueous solution.	• Correct observation for one reagent. • ONE correct product.	• Links observation to chemical or physical property for TWO compounds. • BOTH products correct.	• All compounds correctly identified with reference to chemical / physical properties and one correct products

(iii)	Add (damp) red litmus paper to both samples. Compound J will turn the litmus paper blue while Compound K will not change the colour of the litmus. OR Add (damp) blue litmus paper to both samples. Compound K will turn the litmus paper red while Compound J will not change the colour of the litmus. OR Add Mg (or other reactive metal) to both samples. Compound K will react to form bubbles of hydrogen gas. No bubbles form with Compound J.	• Correct reagent with one observation.	• Correct reagent and two observations.	

(b)(i)	 Compound M  Compound N  Compound O  Compound P Reagent 1: H_2 / Pt OR H_2 / Ni Reagent 2: Cl_2 / UV light Reagent 3: NH_3(alc) Reagent 4: conc H_2SO_4	• TWO compounds correct. • TWO reagents correct.	• SIX correct.	• EIGHT correct with minor error.
(ii)	Compound N is the major product / forms in the greater amount. In an addition reaction, the major product forms when the hydrogen atom is added to the carbon of the double bond with the most carbon atoms attached. In propene, C_1 has two hydrogen atoms, while C_2 has only one hydrogen atom. This means the major product forms when the hydrogen atom is added to C_1 (and the OH group to C_2), forming compound N (propan-2-ol).	• Correct compound with partial explanation.	• Correct compound with full explanation.	

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

Cut Scores

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