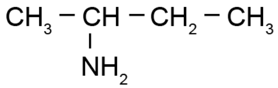
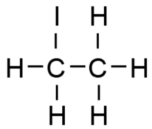
Assessment Schedule – 2020

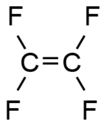
Chemistry: Demonstrate understanding of the properties of selected organic compounds (91165)

Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	 pentan-2-ol 2-methylhex-2-ene 	• TWO correct.		
(b)	Pentan-2-ol is a secondary alcohol because the OH is bonded to a carbon that is bonded to two other carbons.	• Identifies pentan-2-ol as a secondary alcohol.	• Links structure of pentan-2-ol to correct classification.	
(c)(i)	$CH_3CH_2OH \rightarrow CH_2{=}CH_2$	• Correct structural formulae of both molecules.		
(ii)	A reaction with dilute H_2SO_4 will convert an alkene / ethene into an alcohol / ethanol. This is an addition reaction with water, (using H_2SO_4 as a catalyst0. The double bond is broken and 1 × H (atom) and 1 × OH (group) are added to the carbon atoms. If concentrated H_2SO_4 (and heat is used), an elimination reaction occurs, converting an alcohol / ethanol to an alkene / ethene. 1 × H (atom) and 1 × OH (group) will be removed. A double bond is formed.	• Identifies one reaction type.	• Explains ONE type of reaction linked to correct reactant and correct reagent and reaction type.	• Explain BOTH types of reaction linked to reactants, correct reagent and products.

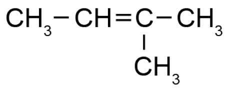
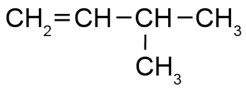
(d)	Compound A $CH_3-CH_2-CH_2Cl$ Compound B $CH_3-CH_2-CH_2NH_2$ Compound C $H_3C-CH_2-C(=O)-O^-$ Reagent X KOH(*aq*) / NaOH(*aq*) Reagent Y H^+ / MnO_4^- or MnO_4^- or H^+ / $Cr_2O_7^{2-}$ Reaction type 1: addition Reaction type 2: substitution Reaction type 3: oxidation	• THREE correct.	• FIVE correct including: - one correct structure - one correct reagent - one correct reaction type.	• ALL correct. MINOR ERRORS ONE only of: • minor and major products around the incorrect way.

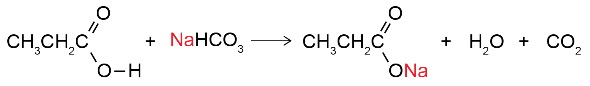
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	1a	2a	3a	4a	2m	3m	2e (minor error)	2e

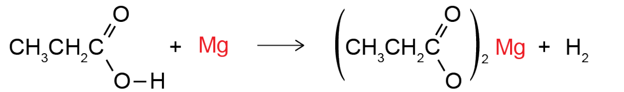
Q	Evidence	Achievement	Merit	Excellence
TWO (a)(i)	 (1,1,2,2)-tetrafluoroethene	• Correctly draws the monomer. OR Correctly names the monomer.	• Links correct structure to current name.	
(ii)	Each monomer contains a reactive double bond between the two carbons. The polymer has only single carbon-carbon bonds, which are not as reactive. Therefore, the polymer is less reactive, which is important when cooking using Teflon cookware, as it won't react with any food or liquid or ability to withstand heat whilst cooking.	• Describes the structural difference between the monomer (C=C) / double bond / unsaturated and polymer(C–C) / single bond / saturated. OR Recognises that the formation of the polymer is an addition reaction. OR The monomers join to form a chain • Monomer more reactive than polymer, so Teflon used to coat cooking utensils.	• Links double bond to reactivity. AND Links single bond to non-reactivity.	• Justifies use of Teflon in cooking by explaining reactivity differences between monomer and polymer.

(b)(i) (ii) (iii)	Constitutional / structural. Geometric. Constitutional isomers have the same molecular formula, but a different arrangement of their atoms. All three molecules have a formula of C_4H_8 / but **A** has a double bond on the first carbon, whereas **B** and **C** have their double bond on the second carbon / **A** is named but-1-ene, whereas **B / C** are named but-2-ene. To form geometric isomers, a carbon-carbon double bond is required, and the atoms / groups and on each of the C atoms of the double bond must be different. Both **B** and **C** have a methyl CH_3 (group) and H (atom) attached on each of the C atoms of the double bond. The carbon-carbon double bond is rigid / fixed, so does not allow rotation to occur around it. Molecules have a different spatial arrangement. When both the CH_3 groups / H atoms are on the same side of the double bond, it is the *cis* isomer. This is molecule **B**. When both the CH_3 groups / H atoms are on different sides of the double bond, it is the *trans* isomer. This is molecule **C**. Molecule **A** is not a geometric isomer because the atoms on the first carbon of the double bond are the same.	• Circles TWO correct answers. • Defines constitutional (structural isomers). • Describes a feature of geometric isomerism.	• Links a feature of constitutional isomerism to molecules **A and B**, • Links a feature of geometric isomerism to molecule **B** and **C**.	• Fully explained all features of constitutional isomerism with regards to molecules **A and B**, • Fully explained features of geometric isomerism with regards to molecule **B** and **C**.

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

Q	Evidence	Achievement	Merit	Excellence
THREE (a)(i)	major  (2-methyl-but-2-ene) minor  (3-methyl-but-1-ene)	• Both major and minor products are drawn correctly.		
(ii)	This is an elimination reaction because a double bond is formed as Cl and H atoms are removed from the molecule. Two products are formed in this reaction because the double bond can form on either side of the carbon attached to the Cl group. One product is produced in greater quantities (the major product) than the other (minor product). The major product is identified by the C losing the H atom to form the double bond that already has fewer H atoms directly attached to it. This is the carbon to the right of Cl / carbon 3, as it has 1 hydrogen compared to the carbon to the left of Cl / carbon 1 as it has 3 hydrogen. Carbon 1 is more likely to lose another H atom ('poor get poorer' concept). The most common product, the major product, is therefore 2-methyl-but-2-ene, and 3-methyl-but-1-ene is the minor product.	• Elimination reaction identified.	• Elimination reaction identified and explained. • Explains why there are two products formed in this reaction with reference to 2-chloro-3-methyl-butane. OR Explains why 2-methyl-but-2-ene is the major product. OR Explains why 3-methyl-but-1-ene is the minor product.	• Elaborates by explaining the reaction type AND why two products form AND how the major 0R minor products are determined.

(b)(i)	When sodium hydrogen carbonate solution is added to each of the three liquids: Ethanol and hexene can be distinguished, as ethanol will be soluble/mix in the aqueous solution no layers seen and hexene will be insoluble and will form two layers. Propanoic acid can be identified, as bubbles of CO_2 will be seen (and there will be one layer) due to it being an acid-base reaction / neutralisation /acid-carbonate reaction.  propanoic acid, sodium hydrogen carbonate, sodium propanoate, water, carbon dioxide	• ONE correct observation. (Do not accepted observation with water and ethanol / hexene) OR One correct organic product (name or formula).	• Links observations to chemical or physical property for ONE organic molecule.	• Outlines a valid procedure that correctly identifies and justifies each liquid with correct chemical equation.

(ii)	**Bromine water** The bromine water with propanoic acid will remain red-brown / orange / brown / yellow colour OR react slowly in presence of UV light with the red-brown / orange / brown / yellow colour fading to colourless.. Bromine water with hexene will have a colour change from red-brown / orange / brown / yellow colour to colourless. This is an addition reaction. OR **Acidified Potassium permanganate** The potassium permanganate with propanoic acid will remain purple. There will be no reaction. Potassium permanganate will have a colour change from purple to colourless in the hexene. This can be considered an addition and / or an oxidation reaction. OR **Non Acidified Potassium Permanganate** The potassium permanganate with propanoic acid will remain purple. There will be no reaction. Potassium permanganate will have a colour change from purple to brown in the hexene. This can be considered an addition and / or an oxidation reaction. **Valid test (not Litmus)** E.g. a reactive metal will identify propanoic acid, as bubbles of gas will be observed. This is a metal acid reactions. E.g. magnesium metal  propanoic acid; magnesium; magnesium propanoate; hydrogen Hexene with magnesium no reaction as no bubbles will be observed.	• Correct reagent identified. • Correct observation.	• Links reagent to a correct observation OR reaction type.	• Explains the reagent, observations, and reaction type to distinguish the molecules.

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

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 –7	8 – 13	14 – 18	19 – 24