Assessment Schedule – 2023

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

Evidence

Q	Evidence	Achievement	Merit	Excellence
ONE (a)(i)	1-chloropentane HCOOH butan-2-amine / 2-aminobutane $CH_3CH_2CH_2OH$	• 2 / 4 correct.		
(ii)	Add damp red litmus paper to all samples. The substance that turns the red litmus blue is compound C (butan-2-amine), as it is an **amine**, which are **basic** compounds. Add aqueous acidified permanganate to the remaining samples. The one that turns the purple permanganate colourless is compound D (propan-1-ol), as it is a primary **alcohol** and can be **oxidised** by permanganate to form CH_3CH_2COOH. The remaining two samples can be distinguished through their solubility in the aqueous permanganate solution. Compound A (1-chloropentane) is a haloalkane and is **insoluble** in this solution, so will form **two layers**, while compound C (methanoic acid) is a carboxylic acid which is **soluble** and will **dissolve**.	• Correct observation for one reagent. • Correctly identifies propanoic acid formed in oxidation of propan-1-ol.	• Links observation to chemical or physical property for two compounds.	• Devises a workable procedure to identify three compounds, with reference to chemical / physical properties.
(b)(i)	Alcoholic ammonia / concentrated ammonia / NH_3 (alc) / NH_3 (conc.)	• Correct reagent.		
(ii)	A substitution reaction is occurring as one atom / group is substituted for another atom / group. In this case, a Br atom is substituted for a NH_2 group.	• Identifies substitution with definition.	• Links reaction type and reagent to structure of reactant and product.	

(c)(i)	When compound A reacts with alcoholic KOH, pent-1-ene is formed, $CH_2{=}CHCH_2CH_2CH_3$. This is an elimination reaction. When compound A reacts with aqueous KOH, pentan-1-ol is formed, $CH_3CH_2CH_2CH_2CH_2OH$. This is a substitution reaction.	• Correctly identifies different conditions of KOH. OR One product correct.	• Correctly links condition to product and reaction type for ONE reaction of KOH.	• Elaborates upon the reactions of KOH with reaction types, products, and identification using bromine water.
(ii)	When bromine water is added to both products, pent-1-ene will rapidly react, turning the bromine water from orange / brown to colourless. The other product, pentan-1-ol will not react / will slowly react in the presence of UV light.	• Correct observation of one product with bromine water.	• Links observation to compound reacting to distinguish products.	

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

Q	Evidence	Achievement	Merit	Excellence
TWO (a)(i)	Compound E: $CH_3CH_2CH_2CH{=}CHCH_3$ Compound F: $CH_3CH_2CH_2CH_2CH{=}CH_2$ Compound G: $CH_3CH_2CH_2CH_2CH_2COOH$ Reagent 1: H_2O / H^+, dilute acid, $H_2SO_4(aq)$ Reagent 2: MnO_4^- / H^+,$Cr_2O_7^{2-}$ / H^+ Reagent 3: NaOH, Na_2CO_3, $NaHCO_3$ Reaction Type 1: Elimination Reaction Type 2: Oxidation Reaction Type 3: Acid-base / neutralisation	• 3 / 9 correct.	• 5 / 9 correct.	• 8/9 correct.
(ii)	Secondary alcohol. The carbon atom that the hydroxyl group is bonded to is directly bonded to two other carbon atoms.	• Correct classification with general reason.	• Correct classification related to molecule	
(iii)	Hexan-2-ol is an asymmetrical alcohol, meaning two products can be formed, depending upon which neighbouring carbon the hydrogen atom is eliminated from. The major product forms when the OH group is eliminated, along with a H atom from the neighbouring carbon with the least number of H atoms attached. In hexan-2-ol, C_1 has three H atoms, while C_3 only has two; therefore the major product is when the hydrogen is eliminated from C_3, forming hex-2-ene (and the minor product is hex-1-ene).	• Identifies asymmetric alcohol. • Correctly assigns major and minor products OR States how major / minor products can be identified	• Explains why two products are formed. • Explains how major / minor products can be identified.	• Justifies why two products are formed and how to identify major / minor products, with reference to the structure of hexan-2-ol.
(iv)	Any primary alcohol with molecular formula $C_6H_{14}O$. eg: $CH_3CH_2CH_2CH_2CH_2CH_2OH$	• Correct structure.		

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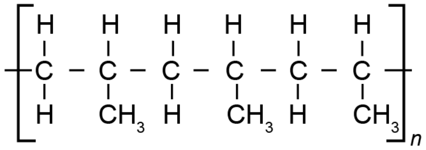
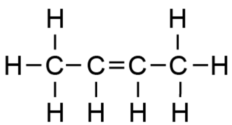
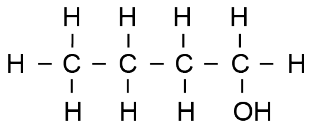
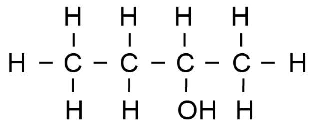
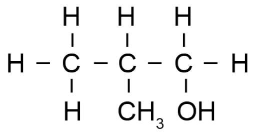
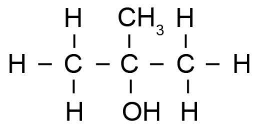
No response; no relevant evidence.	1a	2a	3a	4a	3m	4m	2e minor error	2e

Q	Evidence	Achievement	Merit	Excellence
THREE (a)(i)		• Correct polymer.		
(ii)	The double bond in each propene unit is broken leaving a single C–C bond and enabling two new single C–C bonds to form between monomer units, therefore connecting many of the monomers into long repeating polymer chains.	• Describes an addition reaction. OR Describes a polymerisation reaction.	• Fully explains addition polymerisation.	• Fully explains addition polymerisation and reactivity of each molecule linked to their structure
(iii)	Polypropene is a saturated molecule containing only single C–C bonds, which are much less reactive compared to the unsaturated double C=C bond present in each propene unit. The unreactive nature of this polymer means it is a suitable material for use in a face mask, as it will not react with moisture / water in breath or oils in the skin.	• Identifies polymer as less reactive than monomer. OR States why low reactivity is good for face masks	• Explains relative reactivity of each molecule and links it to their structure.	
(b)	 Geometric isomers must contain a C=C double bond to prevent rotation of the attached atoms around this bond, therefore fixing the atoms' positions in space. It must also have two different groups / atoms attached to each carbon that is involved in the double bond. The proposed structure contains a double bond between C_2 and C_3, and on each carbon of the double bond there are two different groups attached. In this case a CH_3, methyl group and a single hydrogen atom, H.	• Correct structure. • States one correct criteria for geometric isomerism.	• Explains one criteria for geometric isomerism.	• Justifies proposed structure by linking it to both criteria for geometric isomerism.

(c)(i)	 butan-1-ol  butan-2-ol  methylpropan-1-ol  methylpropan-2-ol	• Two isomers drawn correctly. OR One isomer drawn and correctly named.		
(ii)	These molecules are structural isomers because they share the same molecular formula, $C_4H_{10}O$, but their atoms are arranged / bonded differently / they have a different structural formula.	• Defines structural isomerism.	• Explains why the structures are structural isomers.	

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

Cut Scores

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