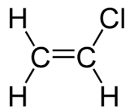
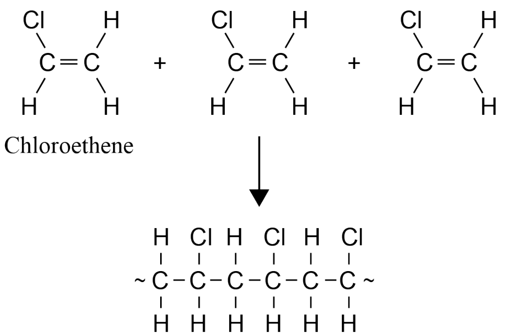
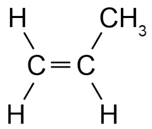
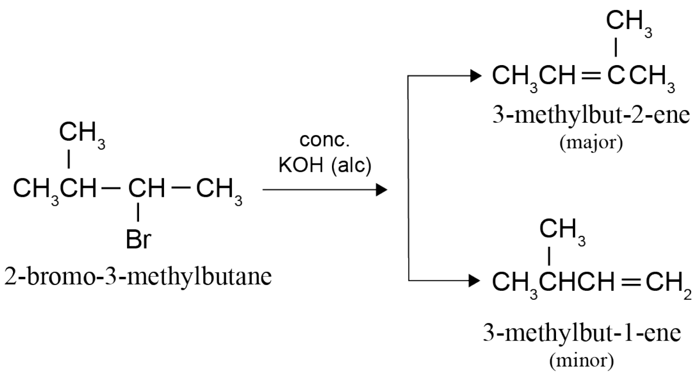
Assessment Schedule – 2017

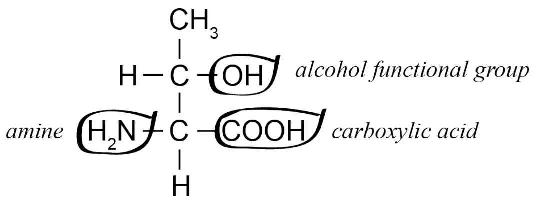
Chemistry: Demonstrate understanding of the properties of selected organic compounds (91165)

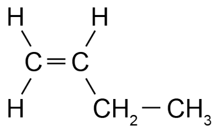
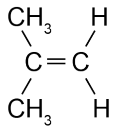
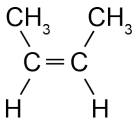
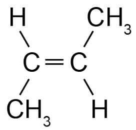
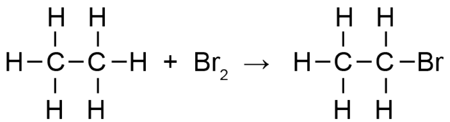
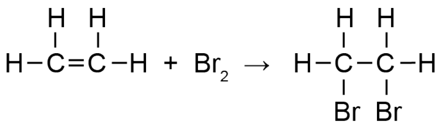
Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)(i)		• Correctly draws the monomer. OR Either identifies monomer or polymer reactivity / physical property.		
(ii)	Each monomer contains a reactive double bond, the polymer has none in its structure. Therefore, the polymer is less chemically active than the monomer (or discusses physical property such as melting point). This means polymers are less reactive, so they can be used in many ways such as seat covers or clothing because they do not react with water.		• Explains why the reactivities / physical property of the monomer and polymer are different, and links this to at least one use.	
(iii)	Addition reactions involve two (or more in the case of the polymers) molecules combining to make one molecule. An addition reaction occurs when double bonds are broken to form a single C–C bond, and two new single covalent bonds. In addition polymerisation, the monomers, chloroethene / vinyl chloride join in a long chain polymer, polyvinyl chloride, as the double bonds break and the C-atoms from each monomer are able to bond to C-atoms in other monomers.  Poly (chloroethene) (PVC)	• Describes an addition reaction OR Suitable equation.	• Explains what the term 'addition polymerisation' means.	• Explains the 'addition polymerisation' term with a suitable equation.

(b)(i)	 (+ HCl)	• Identifies the organic product correctly. OR Describes a way of identifying the presence of the double bond.	• Explains how to identify the presence of a C=C functional group, including observations and correct structure.	
(ii)	The organic product contains a double bond, it is an alkene and could be identified by reacting with $Br_2(aq)$, the orange solution will decolourise when reacted with an alkene; or react with $KMnO_4$, a purple solution that will turn brown when it reacts with an alkene.			
(iii)	In this elimination reaction, because 2-bromo-3-methylbutane is an asymmetric haloalkane, two organic products form. The Br atom is removed from the C2 atom, along with an H atom off an adjacent C atom, to form a C=C double bond. There are two H atoms that could be removed; one from the C1 atom or one from the C3 atom. If an H is removed from the C1 atom, 3-methylbut-1-ene will form. If an H is removed from the C3 atom, then 3-methylbut-2-ene forms. Both products are formed, but there is more of one product than the other. These are called major and minor products. To identify which is which (use 'Saytzeff's Rule' or the 'poor get poorer'), we look for the C atom adjacent to the C with Br attached, with the fewest H atoms attached initially, as this is the C atom that is most likely to lose another H atom. Resulting in 3-methylbut-2-ene being the major product and 3-methylbut-1-ene being the minor product.  Note: *if the terms 'Saytzeff's Rule' or 'poor get poorer' are used, they need to be explained to get to M or E level.*	• Identifies ONE of the two organic products formed. OR Identifies the type of reaction.	• Draws both products correctly and identifies the minor product.	• Gives an account of the formation of the isomers and the relative concentrations of the organic products formed, i.e. major and minor products.

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

Q	Evidence	Achievement	Merit	Excellence
TWO (a)(i)	 threonine	• Correctly identifies both amine and carboxylic acid. OR Correctly identifies classification of alcohol.		
(ii) (iii)	Secondary (or 2°) This alcohol group is classified as secondary because the carbon atom that is attached to the OH functional group is bonded to either two other carbon atoms or only one hydrogen atom.		• Explains the classification of the secondary alcohol and correctly identifies both groups in (a)(i).	
(b)	Pent-1-yne 2-bromo-3-methylhexane 2,2-dimethylpentan-3-ol.	• Gives TWO correct names.		

(c)(i)	**1**  **2**  **3**  **4** 	• Correctly draws THREE isomers.		
(ii)	Depends on candidate answers, but 3 and 4 using the answers above. To form *cis* and *trans* isomers, a carbon-carbon double bond is required, and the atoms / groups on each of the C atoms of the double bond must be different. Structure 3 and 4 above, both have a carbon-carbon double bond. This bond is rigid, so does not allow rotation to occur around it. Both structure 3 and 4 also have two different atoms / groups on each of the C atoms of the double bond, an H atom and a CH_3 group. In structure 3, both the CH_3 groups / H atoms are on the same side of the double bond, so it is the *cis* isomer, whereas in structure 4 both the CH_3 groups / H atoms are on different sides of the double bond, resulting in a *trans* isomer.	• Correctly identifies *cis* and *trans* isomers. • States the need for a carbon-carbon double bond AND two different atoms / groups on each C atom of the double bond.	• Explains why the carbon-carbon double bond AND two different atoms / groups on each C atom of the double bond are required.	• Justifies the choice of structures as *cis* and *trans* in terms of the carbon-carbon double bond and the position of the different groups on the carbon atoms of the double bond.
(d)	Alkanes will slowly react with bromine water in the presence of a UV catalyst. The orange $Br_2(aq)$ will decolourise slowly. This is a substitution reaction where one H atom is replaced with a Br atom.  Whereas, alkenes react immediately with orange $Br_2(aq)$, decolouring it to yellow / colourless quickly. Unlike alkanes, alkenes do not require a catalyst for the reaction to proceed. This is an addition reaction, where the double bond is broken, and two atoms of Br are added to the organic structure. 	• Identifies alkenes react faster than alkanes. OR Alkanes need a catalyst to react (UV / sunlight). OR Identifies both types of reaction correctly.	• Explains what happens in the reaction of either an alkene or an alkane with bromine water, $Br_2(aq)$. OR Has an explanation for alkene and alkane but did not contrast with a minor omission.	• Contrasts the conditions and the types of reactions of an alkane and an alkene with bromine water, $Br_2(aq)$.

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

Q	Evidence	Achievement	Merit	Excellence
THREE (a)(i)	Compound **A**. CH_3CH_2OH Compound **C**. CH_3CH_3 Compound **D**. CH_3CH_2Cl Reagent **2**: $Cr_2O_7^{2-}$ / H^+ or MnO_4^- / H^+ Reagent **3**: H_2 / Ni or H_2 / Pt / 150°C	• Any THREE correct in (a)(i).	• Any EIGHT correct from (a)(i) and (ii).	• ALL correct in (a)(i) and (ii).
(ii)	Reaction A: addition (hydration) Reaction B: oxidation Reaction C: addition (hydrogenation) Reaction D: substitution (halogenation) Reaction E: substitution.	• THREE correct in (a)(ii).		
(b)	Red litmus paper will turn blue in a solution of compound **E**, but will not change in **B**. Blue litmus paper will turn red in a solution of compound **B**, but will not change in **E**.	• Identifies a distinguishing test for both compounds.		
(c)(i)	$CH_3COOH(aq) + CH_3CH_2NH_2(aq) \rightarrow CH_3COO^-(aq) + CH_3CH_2NH_3^+(aq)$ (or amide condensation reaction)	• Correctly identifies the products AND Correctly identifies the type of reaction.	• Writes correctly balanced equation.	• Justifies the type of reaction by linking the type of reaction to proton / H^+ transfer with a correctly balanced equation. (*Proton / H^+ transfer only required at E level.*)
(ii)	The reaction between **B** and **E** is an acid-base (neutralisation) reaction. Acid-base reactions involve a proton / H^+ transfer. Protons / H^+, are released from the carboxylic acid functional group, –COOH, resulting in a salt forming containing the $–COO^-$ group. The proton / H^+ is accepted by the amine functional group, $–NH_2$, this forms a salt containing the $–NH_3^+$ group.			
(d)	PCl_3 / PCl_5 / $SOCl_2$ can be used to convert compound **A**, CH_3CH_2OH, an alcohol, to the chloroalkane, CH_3CH_2Cl. This is a substitution reaction where the –OH group in compound **A** is replaced by a Cl atom from PCl_3 / PCl_5 / $SOCl_2$.	• Identifies the reagent PCl_3 / PCl_5 / $SOCl_2$ / Lucas OR substitution OR replaced by Cl.	• Explanation of reaction is given.	

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 – 7	8 – 13	14 – 18	19 – 24