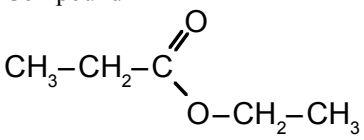
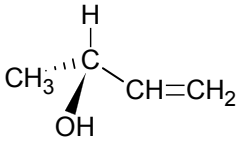
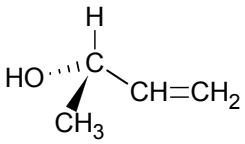
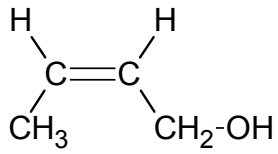
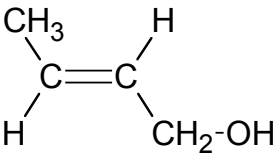
Assessment Schedule – 2005

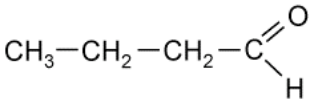
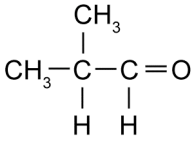
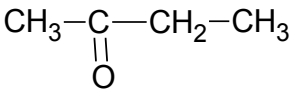
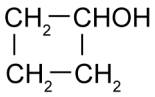
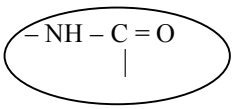
Chemistry: Describe the structure and reactions of organic compounds containing selected organic groups (90698)

Evidence Statement

NOTE: Candidates will be penalised once only for writing structures with missing H atoms.

Q	Evidence		Achievement	Achievement with Merit	Achievement with Excellence
1(a) (i)	Reagent 1 – **KOH** in **ethanol/**alcohol Reagent 2 – NaOH(aq) / NaOH/KOH / KOH (aq) /H_2O with OH^- – *not H_2O* Reagent 3 – $SOCl_2$ / PCl_3 / PCl_5 – *not HCl)*		TWO correct		
1(a) (ii), (iii)	Compound X (Minor product): **$CH_3CH_2CH_2Br$** or full structure Name of minor product: **1-bromopropane** CH_3CH_2COCl is **propanoyl chloride** Compound Y  **OR** CH_3CH_2 $COOCH_2CH_3$ **OR** Full structure Name: **ethyl propanoate**		**EITHER:** Correct structure and name for compound X or Y **OR** Both structures X and Y correct **OR** Correct name for propanoyl chloride and correct name or structure for either compound X or Y **OR** Correct name for both compounds X and Y.	Understanding of reaction sequence demonstrated through **FOUR** answers correct	
1(b)	(i) Elimination	The molecule HCl / a Cl atom **and** an H atom removed **and** a double bond is created.	TWO correct types of reaction.	Two types of reaction correct and each of these two linked with a valid explanation.	
	(ii) Substitution	Br^- /Br; is removed and replaced / exchanged /swapped with /changed for / substituted with; an OH^-/OH group.			
	(iii) Oxidation	Oxygen is added / hydrogen is removed / electrons are lost / the number of bonds to oxygen is increased / the oxidation number of carbon increases / $Cr_2O_7^{2-}$ is an oxidising agent / $Cr_2O_7^{2-}$ is reduced to Cr^{3+} so the alcohol is oxidised.			

Q	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
1(c)	If the major product (2-bromopropane) remains in the flask when reagent 2 (NaOH(*aq*)) is added, a substitution reaction would cause the formation of the **2° alcohol propan-2-ol ($CH_3CH(OH)CH_3$) as well as propan-1-ol)** This would in turn be oxidised by the dichromate to **the ketone/ propanone/ (CH_3COCH_3).** No further reaction with reagent 3 or ethanol will occur, so the final mixture would contain a lot of propanone and a smaller amount of the ester. (If all of the alcohol was not completely oxidised to the ketone, an ester with the ester group attached at the 2nd C atom might form with the propanoic acid and 2-chloropropane might result from excess propan-2-ol reacting with reagent 3.)	**Either** The major product is identified by name /structural formula/ description of Br on the second or middle carbon atom **OR** the nature of the major product is implied by the identification of the subsequent secondary alcohol.	**Either** Answer recognises that there are TWO possible substitution products with OH^- i.e a 1^0 and a $\mathbf{2^0}$ **alcohol** or the named products propan-1-ol and **propan-2-ol**.	Answer clearly indicates that oxidation would produce a **ketone/ propanone** / CH_3COCH_3 (as the final product from propan-2-ol).
2(a)	Enantiomers of compound A  	**One** isomer drawn **correctly** with 3-dimensional arrangement of groups around chiral **OR** The isomers are exact mirror images of a 3D structure that has a minor error in the formula or an error in the way the groups are connected to the chiral C atom.	Both isomers with correct formulae are drawn as enantiomers showing 3-dimensional arrangement around chiral C.	
2(b)	Compound B (cis)  Compound C (trans)  primary alcohols contain a $-CH_2OH$ group/general formula is $R\text{-}CH_2OH$	A correct structure is drawn for ONE compound, ie it contains a 1° alcohol group and an alkene group and is capable of *cis-trans* isomers **OR** Cis and trans isomers are shown but the OH is not 1° **OR** The *cis-trans* relationship is correct but there is a **minor** error in the formula of the 1st compound.	BOTH cis and trans isomers with correct formulae and the OH in the 1^0 position, are correctly drawn in the correct box.	

Q	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
2(c) (i)	Compound D is **butanal**  **OR** **methylpropanal** 	**EITHER** the name **OR** structural formula correct.		
2(c) (ii)	Tollens' – a **silver mirror forms** / silver / black: particles / precipitate / solid. Benedict's – a change from the **blue solution** to green / yellow / orange / **orange-red** / red: colour / **precipitate** /solid	At least ONE of the observations correctly described.		
2(d)	Compound E is  Compound F is  *A cyclic ether is also acceptable for compound E*	ONE structure drawn is correct and in either box.	**EITHER** Compound F, the cyclic alcohol is in correct box **OR** TWO structures correct BUT NOT in the correct box	Valid structure for BOTH compounds **and** in the correct box.
3(a)	(i) 	At least one amide (peptide) link is circled.		
	(ii) Under **alkaline conditions** products would be **H_2N CH CH_2CH_2 COONa** **COONa** **H_2N CH(CH_2SH)COONa** **H_2N CH_2COONa** **OR** The structures above with COO^- instead of COONa Under **acidic conditions** the NH_2 group would be protonated (to NH_3^+) in each case and COOH would be present instead of COO^- / COONa.	**ONE** correct hydrolysis product drawn with either COO^- or COONa or COOH group	**Either** Structures of **TWO** products of the **alkaline hydrolysis** (with COONa, or COO^-) *(not COOH)* **OR** for **the acid hydrolysis** the answer discusses the protonation of the NH_2 (to NH_3^+) and the presence of COOH rather than COONa /COO^-.	Correct structures of **TWO** products of the **alkaline hydrolysis** with COONa or COO^- *(not COOH)* **AND** for **the acid hydrolysis** discusses the protonation of the NH_2 (to NH_3^+) and the presence of COOH rather than COONa /COO^- .

Q	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
3(b)	• A **polymer** is a **long chain molecule** formed when **many molecules or units** (ie monomers**)** link together. • **Polyester** chains are formed by **condensation** with the loss of H_2O or HCl at each ester linkage. • Polyesters contain ester linkages. $-C(=O)-O-$ • A **single monomer** must be a hydroxy alkanoic acid or hydroxy alkanoyl chloride eg $HO(CH_2)_4COOH$ / HO-R-COOH or $HO(CH_2)_4COCl$ / HO-R-COCl • Two different monomers can be a diol and a dioic acid / a diol and a dioyl chloride / two different hydroxy alkanoic acids / two different hydroxy alkanoyl chlorides eg $HOOC(CH_2)_nCOOH + HO(CH_2)_mOH$ $ClOC(CH_2)_nCOCl + HO(CH_2)_mOH$ $HOOC(CH_2)_n\ OH + HOOC(CH_2)_mOH$ $ClOC(CH_2)_n\ OH + ClOC(CH_2)_mOH$	Description includes any TWO of the bullet points	Explanation shows understanding of the need for the monomers to be "double-ended" **AND** general or specific structures are described or drawn for a single monomer / two different monomers that could be used to form a polyester.	Full discussion showing understanding of terms used in the given statement Appropriate structures (general or specific) are drawn for • a single monomer and the repeating unit of the polyester formed from it **AND** • two different monomers **and** the repeating unit of the polyester formed from them.

Judgement Statement

Achievement	Achievement with Merit	Achievement with Excellence
SEVEN opportunities answered at Achievement level or higher. 7 × A	EIGHT opportunities answered with at least FIVE at Merit level or higher. 5 × M *plus* 3 × A	NINE opportunities answered with at least TWO at Excellence level and FOUR at Merit level. 2 × E *plus* 4 × M *plus* 3 × A