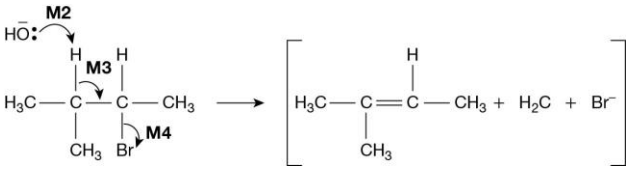
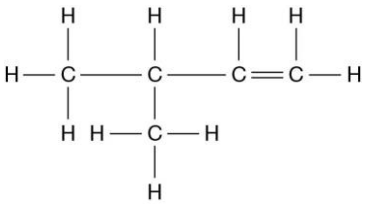
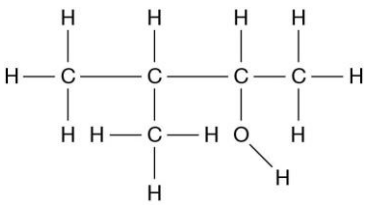
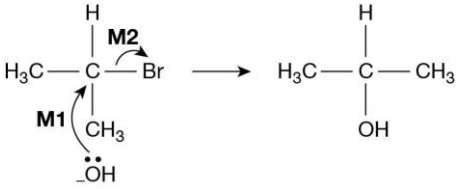
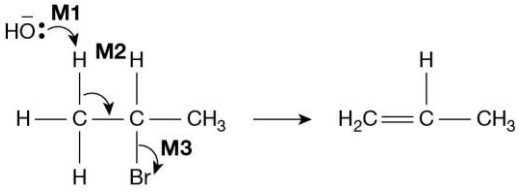
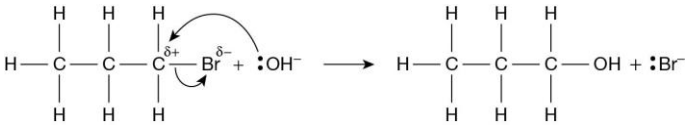
Question number	Answer	Marks	Guidance
1 (a) (i)	**M1 Elimination**  **M2** must show an arrow from the lone pair on the oxygen of a negatively charged hydroxide ion to a correct H atom **M3** must show an arrow from a correct C–H bond adjacent to the C–Br bond to a correct C–C bond. Only award if an arrow is shown attacking the H atom of a correct adjacent C–H bond in **M2** **M4** is independent provided it is from their original molecule, **BUT CE=0 for the mechanism (penalise M2, M3 and M4 only) if nucleophilic substitution mechanism is shown** Award full marks for an E1 mechanism in which **M4** is on the correct carbocation **NB These are double-headed arrows**	4	**M1** Credit "base elimination" but no other prefix. Penalise **M2** if covalent KOH. Penalise **M4** for formal charge on C or Br of C–Br or incorrect partial charges on C–Br Ignore other partial charges. Penalise **once only** in any part of the mechanism for a line and two dots to show a bond. **Maximum any 2 of 3 marks for the mechanism** for wrong organic reactant or wrong organic product (if shown). Credit the correct use of "sticks" for the molecule except for the C–H being attacked. Penalise **M4**, if an additional arrow is drawn from Br eg to K+
1 (a) (ii)	Displayed formula for 3-methylbut-1-ene 	1	All bonds and atoms must be drawn out, but ignore bond angles.
1 (a) (iii)	Position(al) (isomerism or isomer)	1	Penalise any other words that are written in addition to these.
1 (b) (i)	Displayed formula for 3-methylbutan-2-ol 	1	All bonds and atoms must be drawn out, but ignore bond angles.
1 (b) (ii)	Any **one** from	1	Ignore "pressure".

	• Lower / decreased temperature ***OR*** cold • Less concentrated (comparative) ***OR*** dilute KOH • Water (as a solvent) / (aqueous conditions)		
1 (b) (iii)	Nucleophilic substitution	1	Both words needed – credit phonetic spelling.
2 (a) (i)	Nucleophilic substitution  **M1** must show an arrow from the lone pair of electrons on the oxygen atom of the negatively charged hydroxide ion to the central C atom. **M2** must show the movement of a pair of electrons from the C-Br bond to the Br atom. Mark M2 independently. Award full marks for an S_N1 mechanism in which M1 is the attack of the hydroxide ion on the intermediate carbocation.	1 2	Penalise M1 if covalent KOH is used Penalise M2 for formal charge on C or incorrect partial charges Penalise once only for a line and two dots to show a bond. Max 1 mark **for the mechanism** for the wrong reactant and/or "sticks" Ignore product
2 (a) (ii)	2-bromopropane ONLY	1	
2 (a) (iii)	Polar C–Br ***OR*** polar carbon–bromine bond ***OR*** dipole on C–Br ***OR*** C atom of carbon–bromine bond is δ+ / electron deficient ***OR*** *δ+ (δ–)* C—Br (Credit carbon–halogen bond as an alternative to carbon–bromine bond)	1	It must be clear that the discussion is about the carbon atom of the C–Br bond. NOT just reference to a polar molecule. Ignore X for halogen
2 (a) (iv)	moles of halogenoalkane = = 0.0814 theoretical mass of organic product = 0.0814 × 60.0 = 4.88 g percentage yield = 4.6 / 4.88 = 94.3% **Student was correct**	1	
2 (b)	Elimination 	1 3	Credit "base elimination" but NOT "nucleophilic elimination" No other prefix. Mechanism Penalise M1 if covalent

	M1 must show an arrow from the lone pair on oxygen of a negatively charged hydroxide ion to the correct H atom **M2** must show an arrow from the correct C-H bond to the C-C bond and should only be awarded if an attempt has been made at M1 **M3** is independent. Award full marks for an E1 mechanism in which M2 is on the correct carbocation.		KOH Penalise M3 for formal charge on C or incorrect partial charges Penalise once only for a line and two dots to show a bond. Max 2 marks **for the mechanism** for wrong reactant and/or "sticks" Ignore product
2 (c)	Any one condition from this list to favour elimination; • alcohol(ic) / ethanol(ic) (solvent) • high concentration of KOH / alkali / hydroxide OR concentrated KOH / hydroxide • high temperature or hot or heat under reflux or T = 78 to 100#°C	1	Apply the list principle Ignore "aqueous" Ignore "excess"
3 (a)	$CH_3CH_2CH_2Br + OH^- \rightarrow CH_3CH_2CH_2OH + Br^-$	2	
3 (b)	1-bromopropane; propan-1-ol	2	
3 (c)	Br^-	1	
3 (d)	Substitution	1	
3 (e)	It has a lone pair of electrons and a negative charge	2	
3 (f)		2	
3 (g)	Faster, the C-I bond is weaker and breaks more easily than the C-Br bond	2	
3 (h)	They are poorer nucleophiles as they are neutral rather than negatively charged	2	
3 (i)	A proton (H^+ ion) has to be lost	1	