M1.B

[1]

M2.D

[1]

M3.A

[1]

M4.D

[1]

M5.C

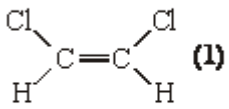
[1]

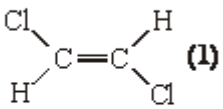
M6.B

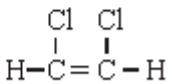
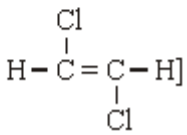
[1]

M7. (a) (i)

Isomer 1 either order *Isomer 2*


(1)

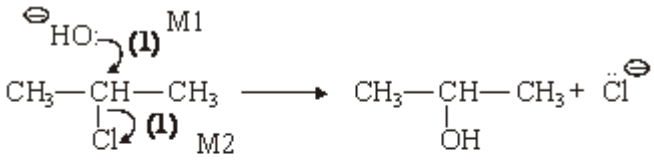

(1)

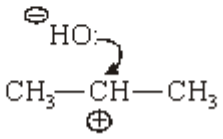
[credit  and ]

(ii) restricted <u>rotation</u> OR no <u>rotation</u> OR cannot <u>rotate</u> **(1)**

3

(b) (i) *Mechanism*:

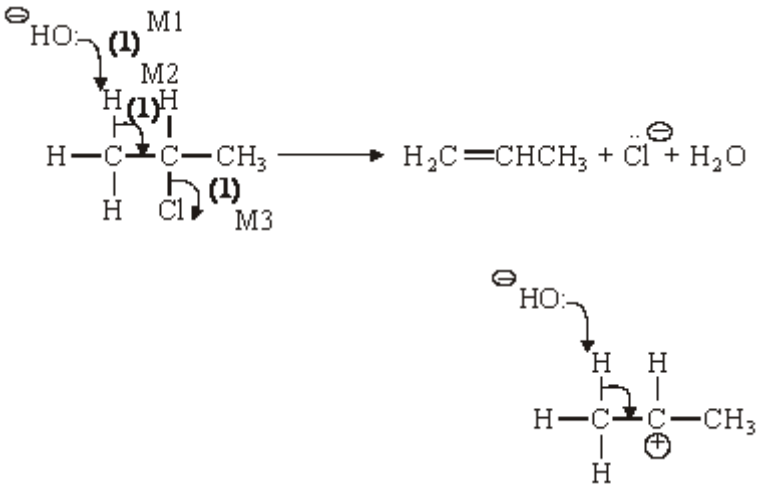


[Credit M1 for ]

M1 and M2 independent
Curly arrows <u>must</u> be from a bond or a lone pair
Do not penalise sticks
Penalise M1 if  *precedes (penalise this once)*
Penalise incorrect δ+ δ– for M2
Penalise + on C atom for M2
Only allow M1 for incorrect haloalkane

Role of the hydroxide ion: nucleophile **(1)**
electron pair donor
lone pair donor
NOT nucleophilic substitution

(ii) *Mechanism*:



Only allow M1 and M2 for incorrect haloalkane unless RE on (i)

+ charge on H on molecule, penalise M1

M3 independent

M2 must be to correct C–C

M1 must be correct H atom

Credit M1 and M2 via carbocation mechanism

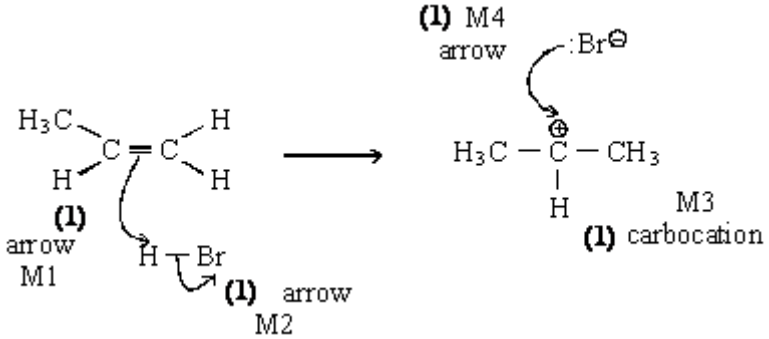
No marks after any attack of C $^{\oplus}$ by OH^-

Role of the hydroxide ion: base **(1)**
proton acceptor
accepts H^+

7

[10]

M8. (a) (i)



If wrong carbocation, lose structure mark
If wrong alkene, lose structure mark

Can still score ¾ i.e. penalise M3
Penalise M2 if polarity included incorrectly
no bond between H and Br
bond is shown as *or*

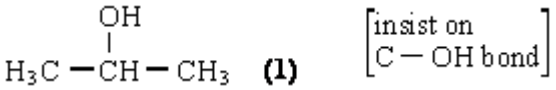
(ii) $CH_3CH_2\overset{\oplus}{C}H_2$ **(1)**

credit secondary carbocation here if primary carbocation has been used in (i)

Ignore attack on this carbocation by $\ddot{Br}^{\ominus}$

5

(b) (i) *Structure*:

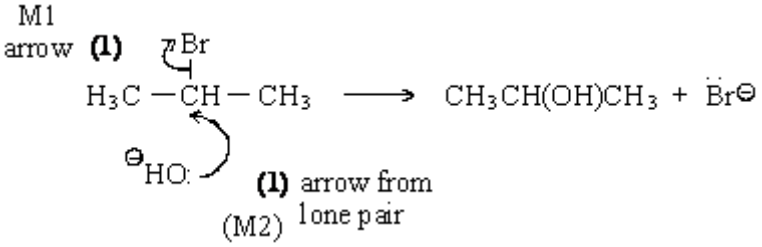


No credit for propan-1-ol even when named correctly
Credit propane-2-ol

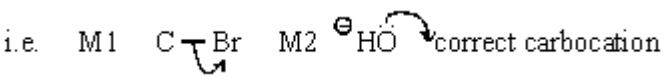
Name: propan-2-ol **(1)**
Not 2-hydroxypropane

(ii) *Name of mechanism*: nucleophilic substitution **(1) (both words)**
(NOT S_N1 or S_N2)

Mechanism:



penalise incorrect polarity on C - Br (M1)
Credit <u>the arrows</u> even if incorrect haloalkane
If S_N1, <u>both marks</u> possible



5

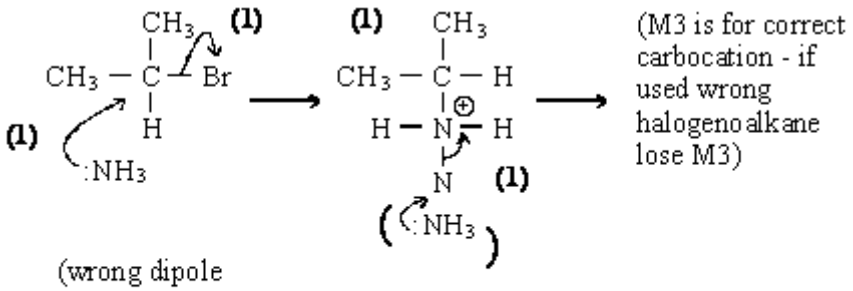
(c) (i) elimination **(1)**
Ignore nucleophylic elimination
Penalise electrophilic elimination

(ii) base **(1)**
OR proton acceptor
NOT nucleophile (base)

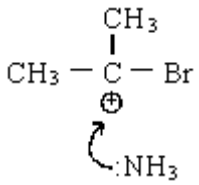
2

[12]

M9. (a) *Name of mechanism*: nucleophilic substitution **(1)**
Mechanism:



Marks S_N1 using same points
∴ *M2 requires*



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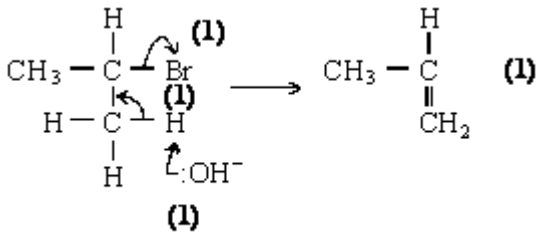
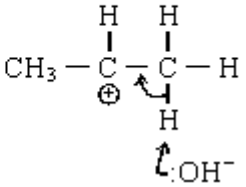
(b) *Role of potassium hydroxide*: Base **(1)**
Mechanism:



Mark E1 using same points

∴ M2/M3



5

[10]

M10. C

[1]

M11. (a) Alcohol: Reaction = Substitution (/ hydrolysis) **(1)**

Ignore reference to nucleophilic, but electrophilic give zero

Alcohol: Role = nucleophile (/ lone pair donor) **(1)**

Alkene: reaction = elimination **(1)**

Ignore ref to nucleophilic or electrophilic

Alkene: base (/ proton acceptor) **(1)**

If no indication of order in (a) assume as in question.
If order is wrong can still score 'role' mark.

4

(b) Alcohol: Role = butan-2-ol **(1)**

Not 2-hydroxybutane or but-2-ol

Appropriate structure for $CH_3CH(OH)CH_2CH_3$ **(1)**

Brackets not essential

S_N2 version S_N1 version

$\overset{\delta+}{C}-\overset{\delta-}{Br}$ bond is polar — C–Br bond is polar **(1)**

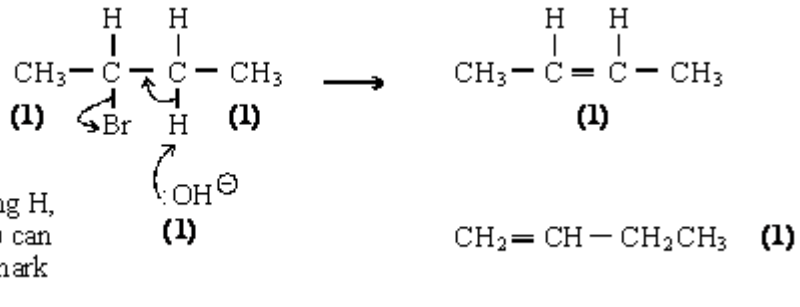
Lone pair of OH^- — C–Br bond breaks **(1)**

Attacks the $C^{\delta+}$ — forming carbocation / carbonium ion **(1)**

M1 can be scored from a diagram, M2 and M3 from written explanation only

5

(c)



if $\ddot{O}H^-$ attacks wrong H, (ie. not on C_1 or C_3) can only score C – Br mark

If but-2-ene not given here it may be obtained from cis / trans isomer

H lost from different carbon atoms (1)
H removes from C^1 and C^3 to give two isomers (1)
Draws clear Cis and trans isomers for but-2-ene

Can score these marks from a diagram

8

[17]