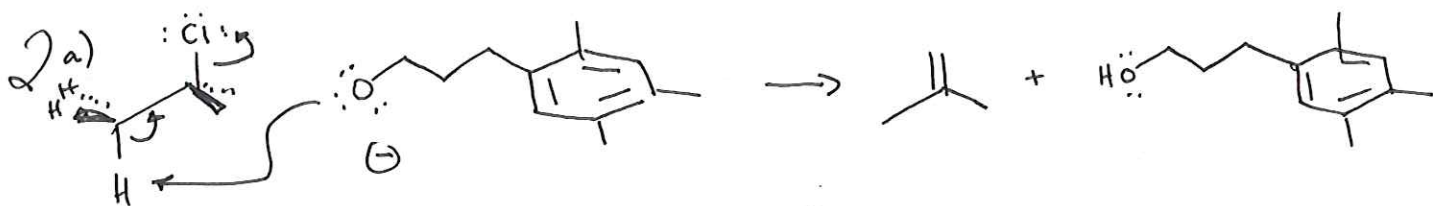


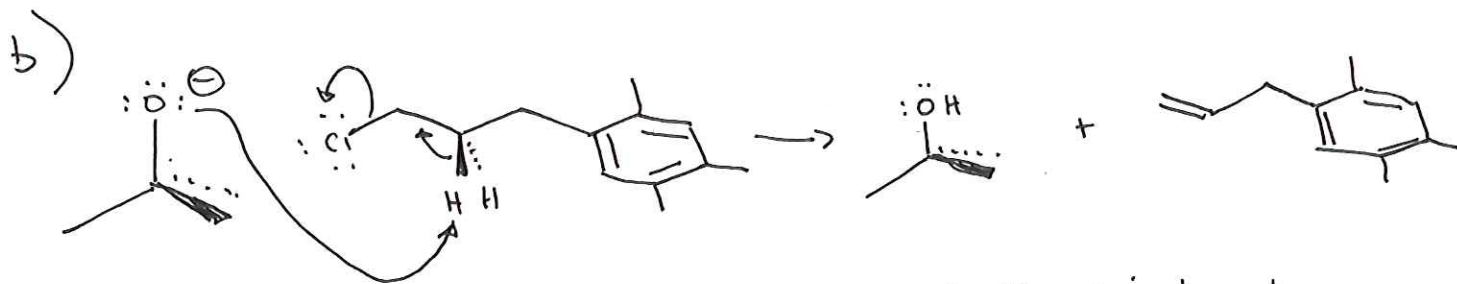
Chem 2500
Assignment #16 - E1/E2/S_N1/S_N2
Answer Key.

1. a) → an elimination occurred (loss of HI),
hence $\text{CH}_3\ddot{\text{O}}:^{\ominus}$ behaved as a base.

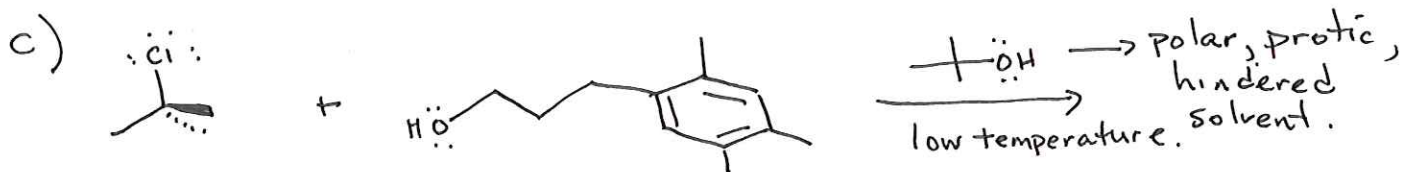
b) → a substitution took place (OCH_3 replaced OTf),
hence $\text{CH}_3\ddot{\text{O}}:^{\ominus}$ behaved as a nucleophile.



→ 3° substrate (electrophile) with a strong base/nucleophile
→ expect E2 reaction (shown above).
→ No reaction did not work as planned.

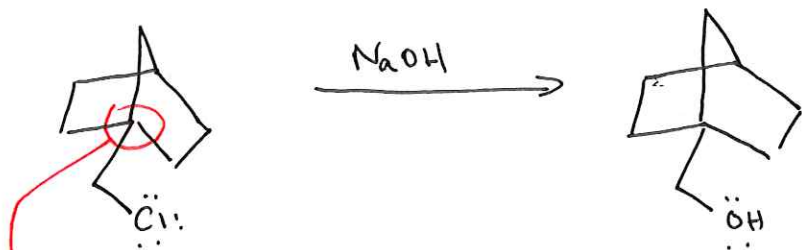
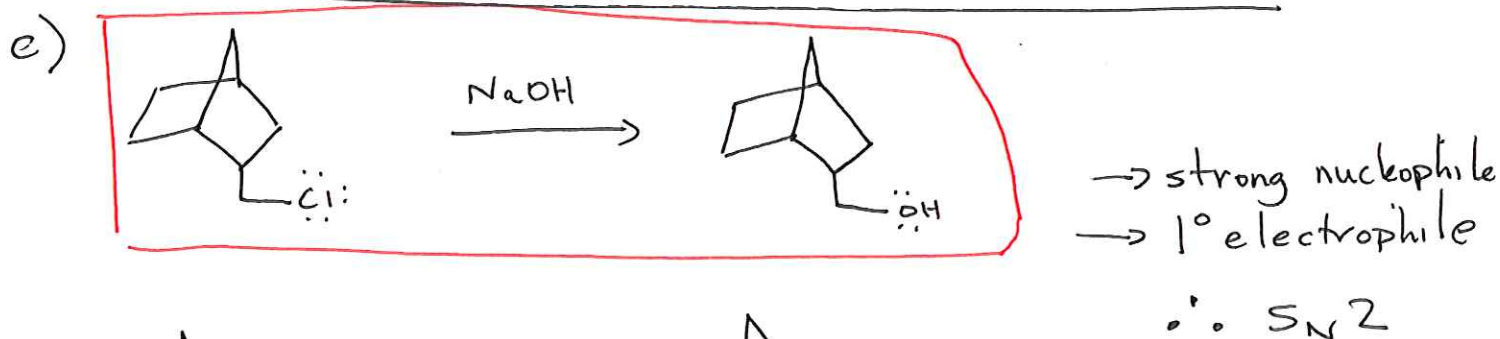
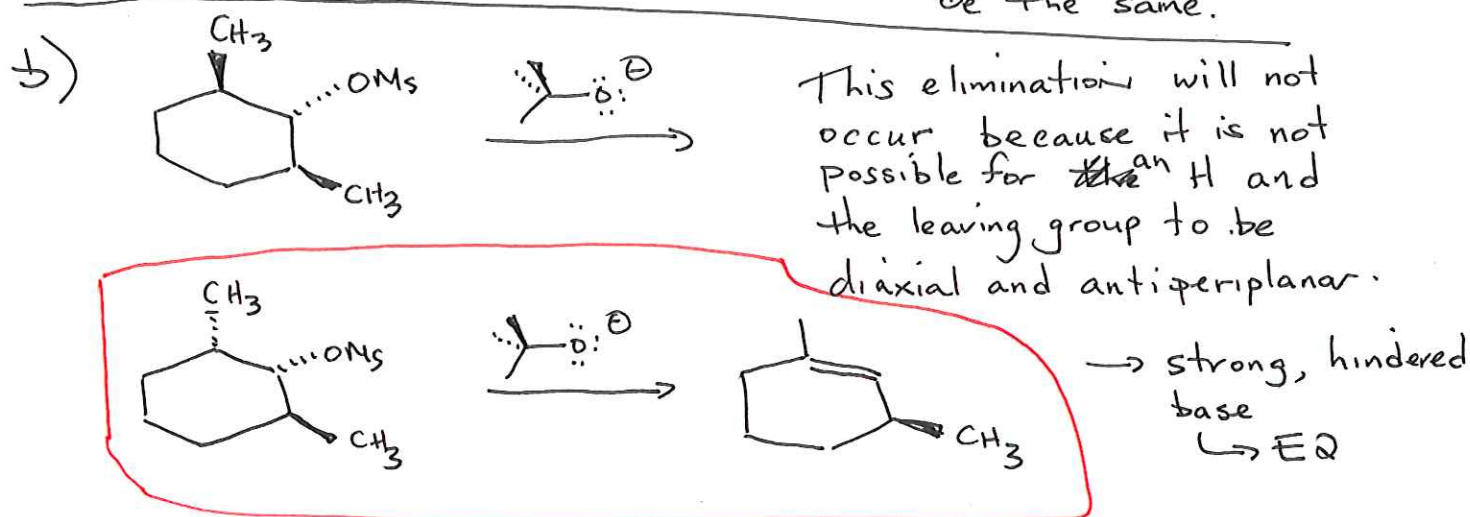
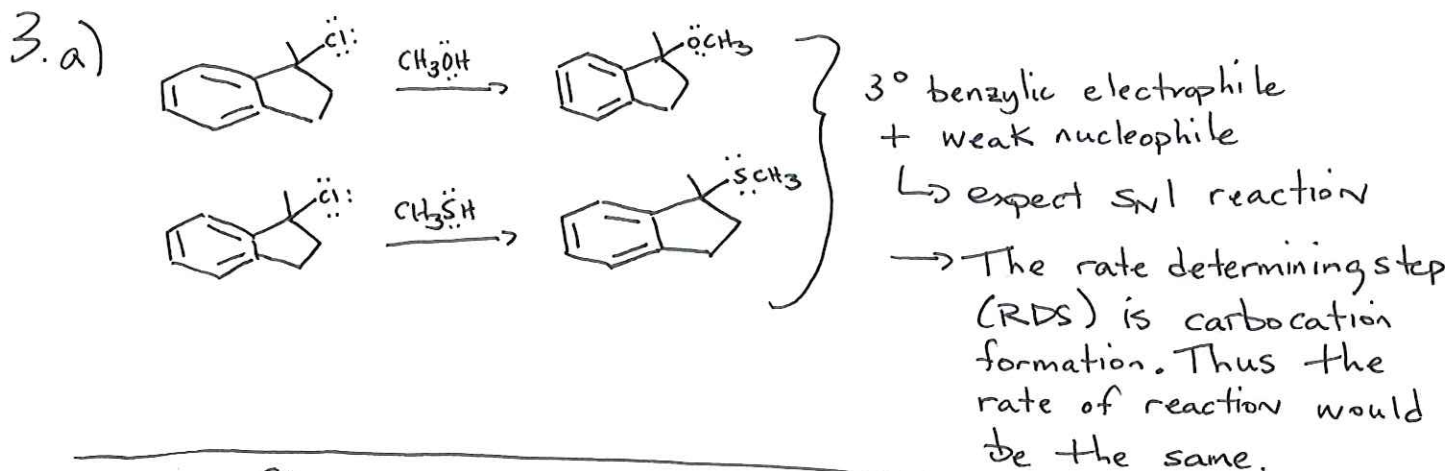


→ 1° electrophile with strong, sterically hindered
base → expect ~~S_N2~~ E2 reaction.
→ No reaction did not work as planned.



→ 3° electrophile and weak base/nucleophile
→ expect S_N1 reaction.
→ polar protic solvent → good for S_N1 reaction.
→ low temperature → favours substitution over elimination

Chem 2500
 Assignment #16 — E1/E2/S_N1/S_N2
 Answer Key

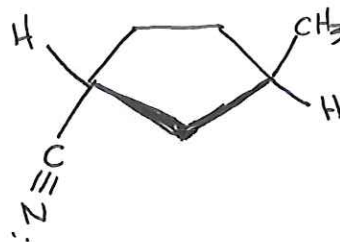
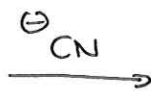


\rightarrow extreme β -branching will slow this reaction.

Chem 2500
Assignment #16 - E1/E2/S_N1/S_N2

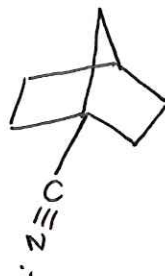
Answer Key

4a)



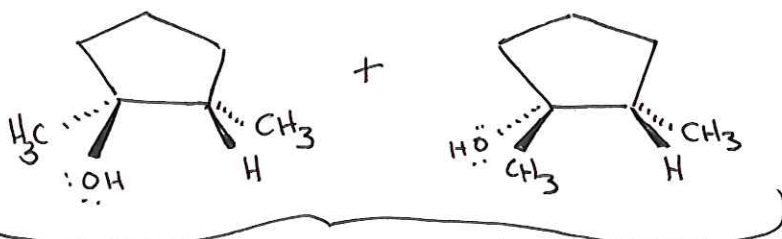
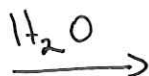
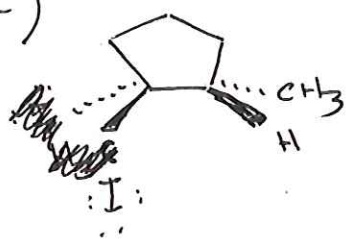
$\rightarrow \text{CN}^-$ is a weak base \therefore no elimination
S_N2, inversion

b)



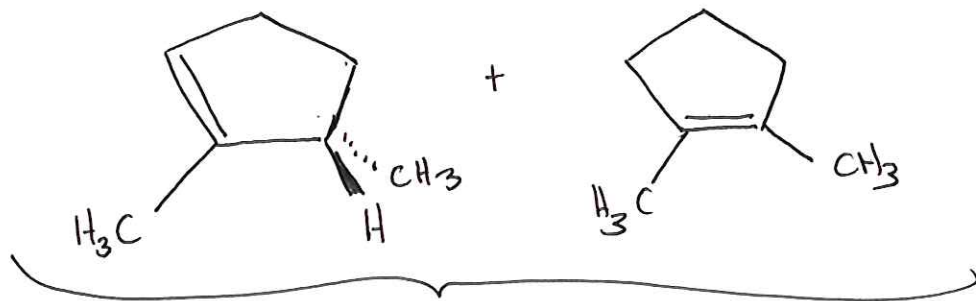
$\rightarrow \text{CN}^-$ is a weak base \therefore no elimination.
 \rightarrow 3° electrophile
 \therefore S_N1

c)



S_N1 products.

\rightarrow 3° substrate, weak base/nucleophile
 \therefore S_N1 and E1



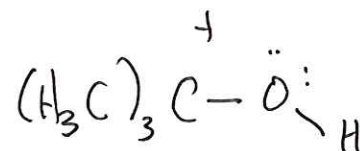
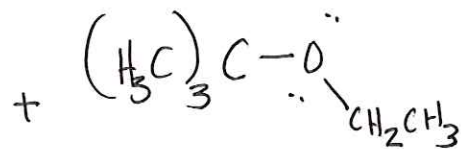
E1 products

d)

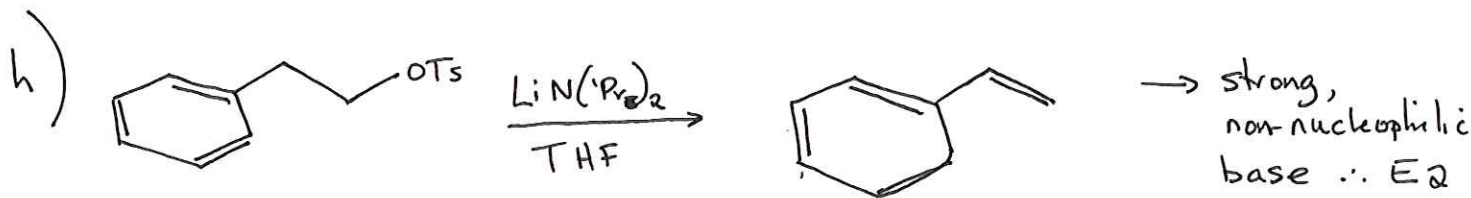
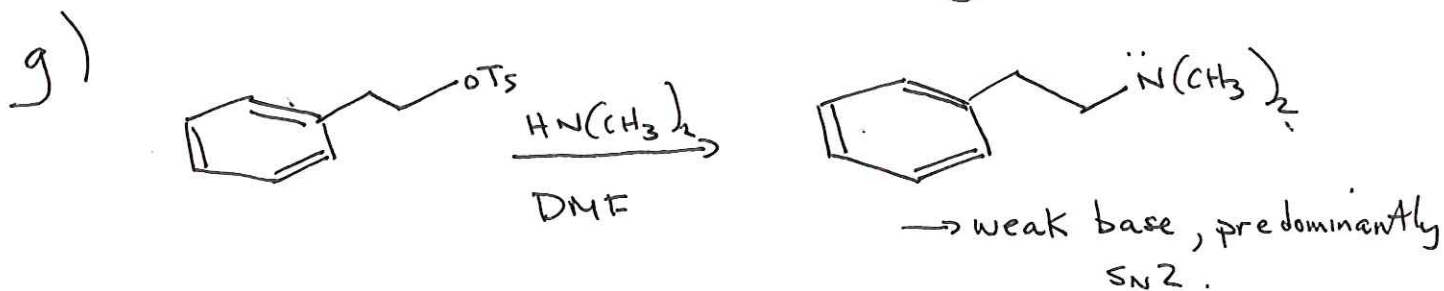
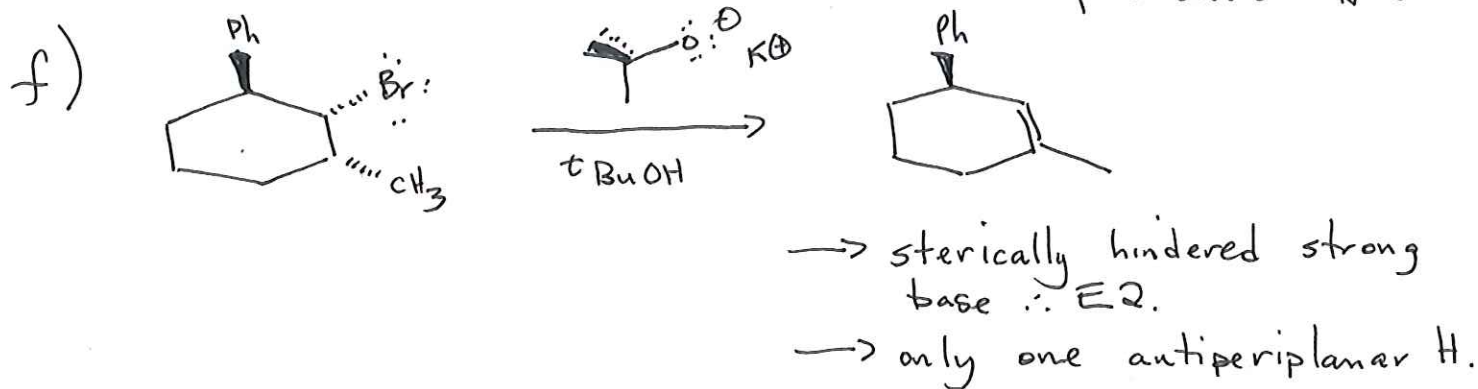
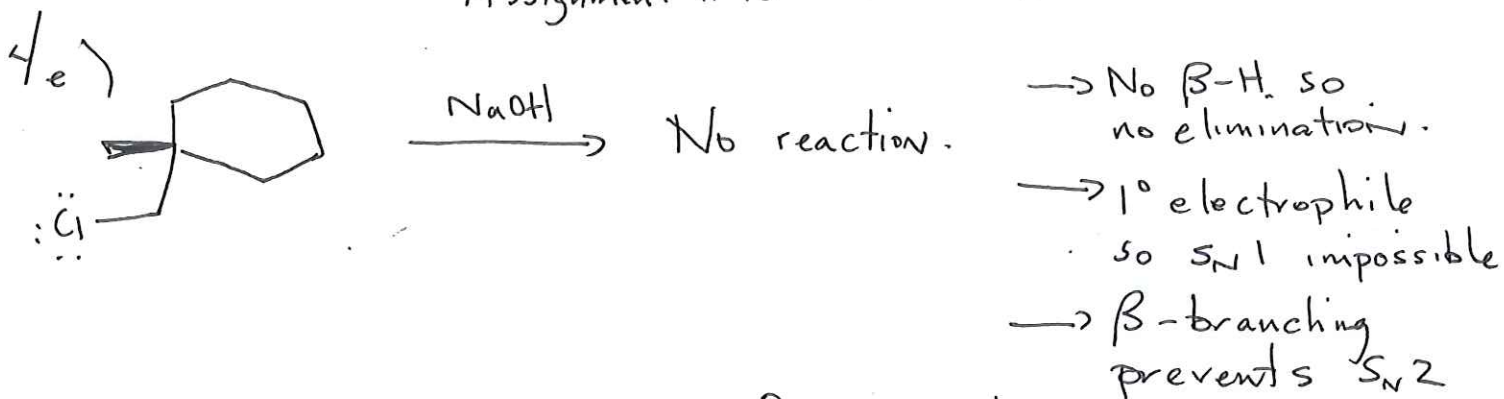


\rightarrow 3° substrate, 2 weak bases/nucleophiles (H_2O , $\text{CH}_3\text{CH}_2\text{OH}$)

\therefore S_N1 and E1



Chem 2500
Assignment # 16 - E1/E2/S_N1/S_N2

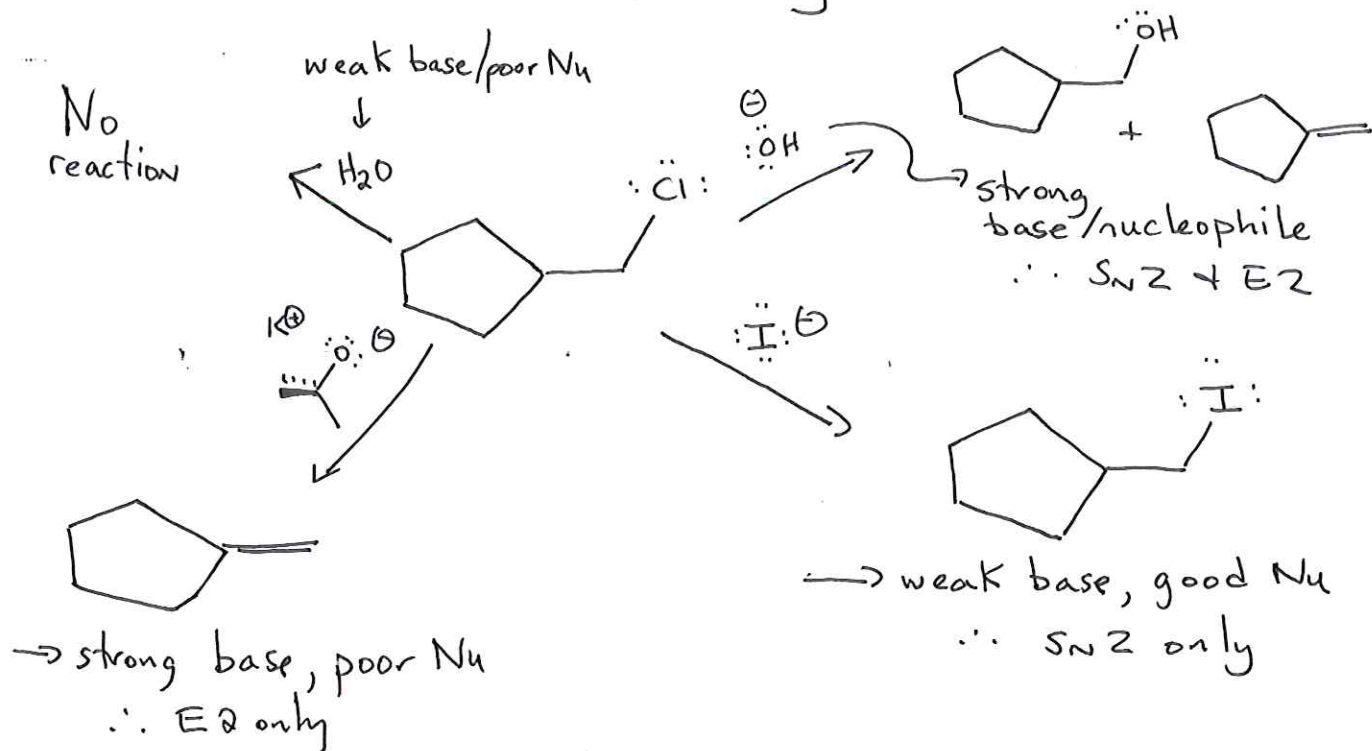


5. → Any reaction wherein the rate determining step involving C-D bond cleavage will be slower than its C-H counterpart (C-D bonds are stronger than C-H bonds). The alcohol products form by substitution (No C-H/C-D bond cleavage) so the rates of reaction are the same. The elimination products however do involve C-H/C-D bond cleavage. An E1 reaction would have the departure of the leaving group as the rate determining step, and the rates of the two elimination reactions would be the same. Since the rates are actually different, an E2 mechanism must be operative.

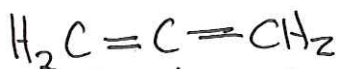
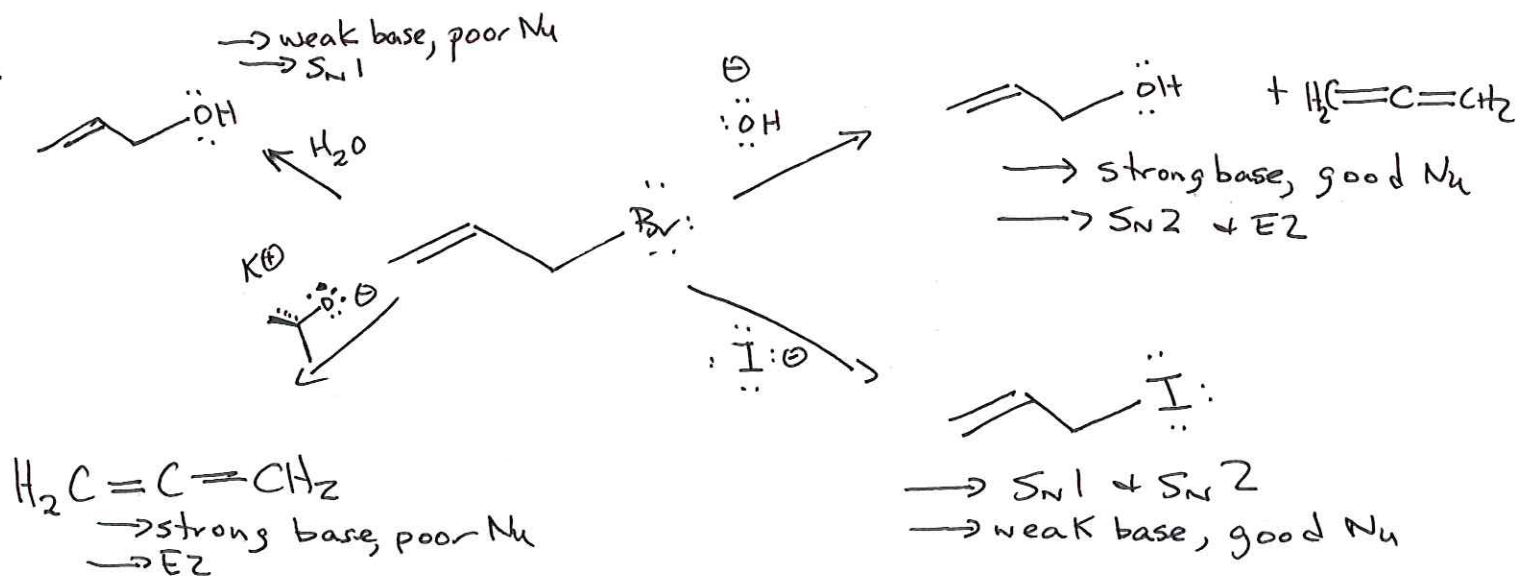
Assignment #16 - E1/E2/SN1/SN2

Answer Key

6



7.

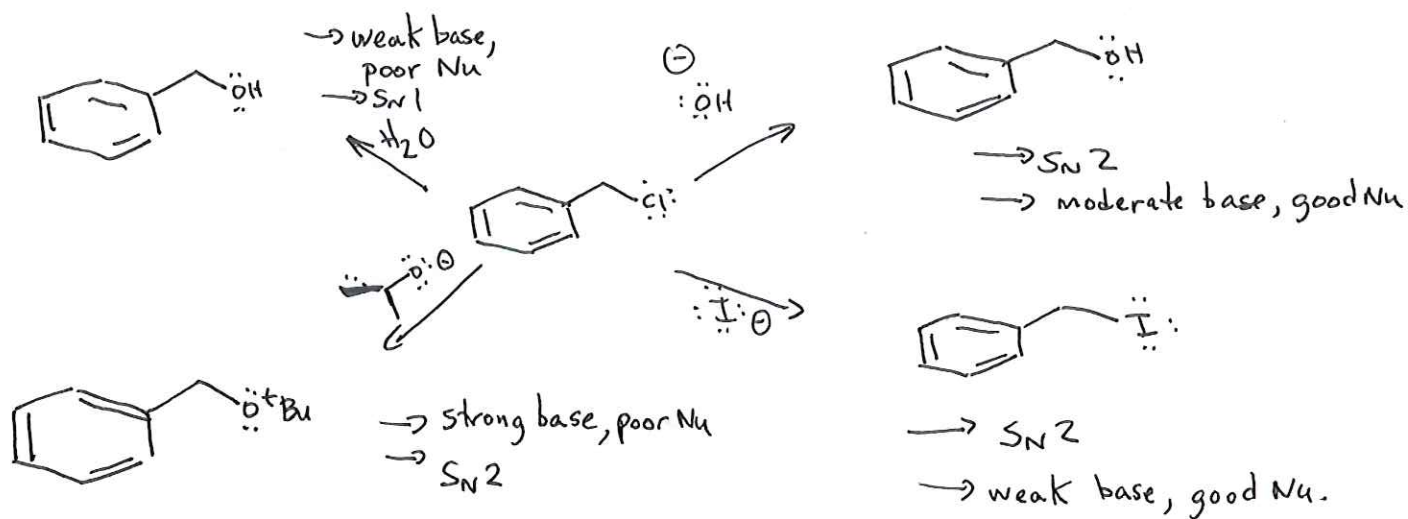


\rightarrow strong base, poor Nu
 \rightarrow E2

\rightarrow substrate is now 1° and allylic so it can form a resonance stabilized carbocation making SN1 and SN2 possible.

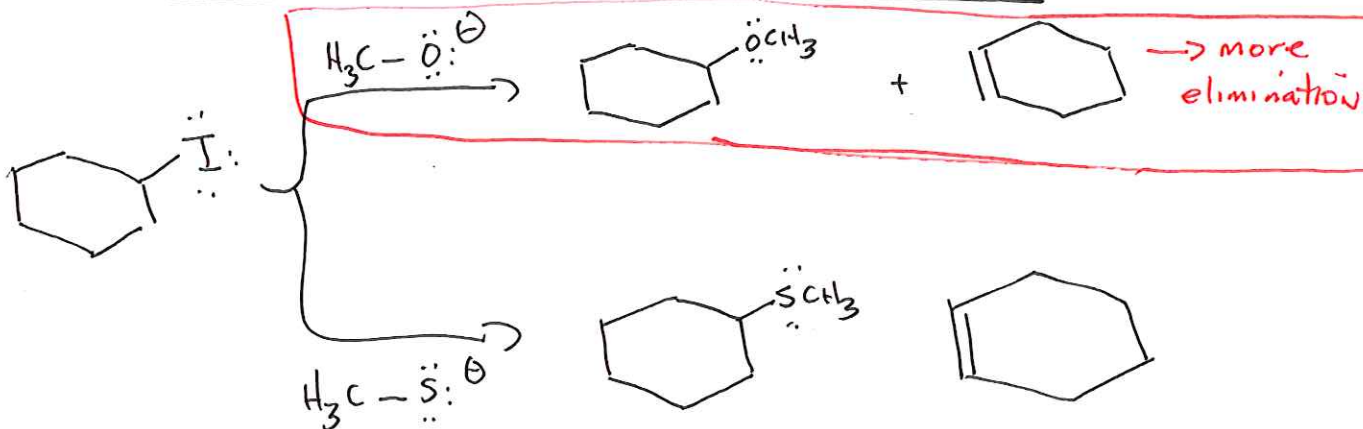
Chem 2500
 Assignment #16 - E1/E2/SN1/SN2
 Answer Key

8.



\rightarrow This substrate can form a resonance stabilized carbocation (1° & benzylic), but it has no $\beta\text{-H}$ which renders E1 & E2 impossible.

9.



\rightarrow S^- is a better nucleophile, but weaker base, hence less elimination would be observed than when O^- is used