

Nucleophilicity/Basicity Clarification

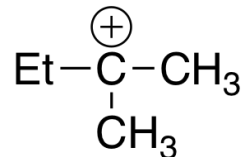
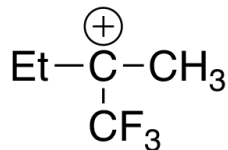
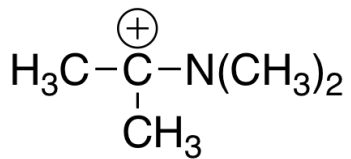
Nucleophile	Relative Rate	Strength	Base	pKa Conj. Acid
HSO ₄ ⁻ , H ₂ PO ₄ ⁻ , RCOOH	<0.01	Very Weak	HSO ₄ ⁻ , H ₂ PO ₄ ⁻ , RCOOH, Cl ⁻ , I ⁻ , Br ⁻	-11 to -3
ROH	1	Weak	ROH	-2
H ₂ O, NO ₃ ⁻	100		H ₂ O, NO ₃ ⁻	-1.5
F ⁻	500	Fair	F ⁻	3
Cl ⁻ , RCO ₂ ⁻	20 × 10 ³		RCO ₂ ⁻ , N ₃ ⁻	5
NH ₃ , (CH ₃) ₂ S	300 × 10 ³		NH ₃ , (CH ₃) ₂ S CN ⁻ , HS ⁻ , RS ⁻ , (CH ₃) ₃ P,	7-9
N ₃ ⁻ , Br ⁻	600 × 10 ³	Good	OH ⁻ , CH ₃ O ⁻	15-17
OH ⁻ , CH ₃ O ⁻	2 × 10 ⁶		H ⁻ , R ⁻	22-50
CN ⁻ , HS ⁻ , RS ⁻ , (CH ₃) ₃ P, I ⁻ , H ⁻	>100 × 10 ⁶	Very Good		

for reference

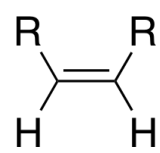
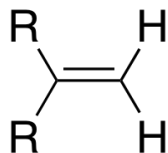
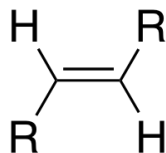
A Little More on Carbocations and Alkenes

Choose the most stable carbocation.

*completed
in class*

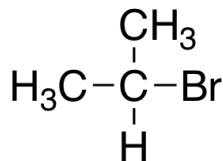


Choose the most stable alkene.



Practice Problems

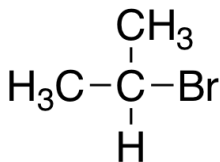
Determine three unique sets of reagents for substitution reactions that for the following compound. Choose reagents that DO NOT lead to elimination products.



- Pick any 3 strong nucleophiles that are also very weak bases!
- I^- and Br^- would be good.
- azide ion and acetate ion would also work
- Definitely use polar aprotic solvent to avoid E1

Practice Problems

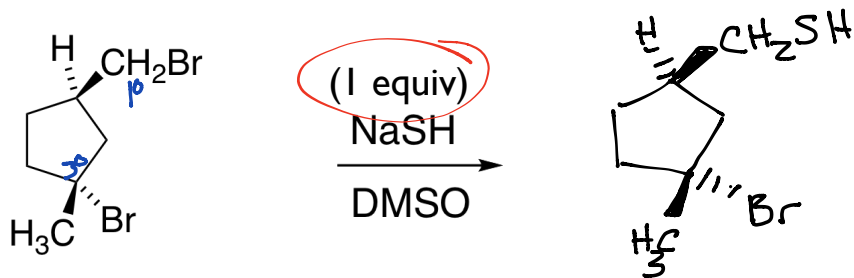
Determine three unique sets of reagents for elimination reactions that for the following compound. Choose reagents that DO NOT lead to substitution products.



- Pick good bases that are poor nucleophiles.
- The three non-nucleophilic bases that you know would all work.
 - t-butoxide
 - DBU
 - DBN
- Avoid polar protic solvents!

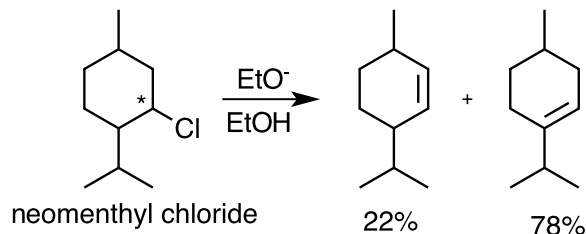
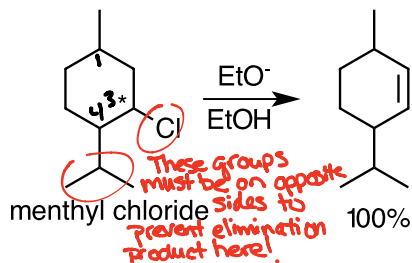
→ S_N1/E1 are ALWAYS in competition!
Avoid them if you have a choice.

Practice Problems



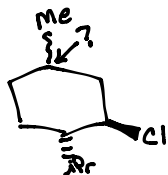
1 equivalent means 1:1 mole ratio of electrophile and NaSH .

Challenge Problem

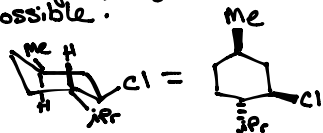


Determine the relative stereochemistry of menthyl chloride and neomenthyl chloride using the reaction data above and the following information:

- 1) Menthyl chloride and neomenthyl chloride differ only in the stereochemistry of the carbon bearing the chlorine.
- 2) Menthyl chloride exists in the most stable cyclohexane configuration.

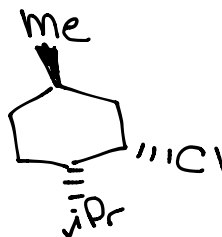


most stable chair would have all groups equatorial if possible.



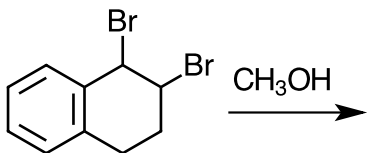
menthyl chloride

SO

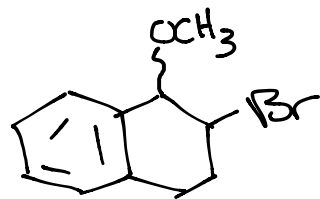


neomenthyl chloride

Challenge Problems



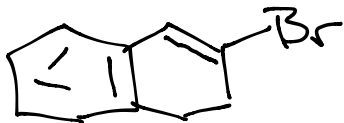
A single substitution product is observed. Draw the structure. Explain.



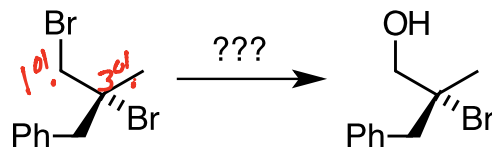
$\text{S}_{\text{N}}1$ at benzylic carbon.
(technically 2 products,
a pair of stereoisomers)

Would you expect any elimination products to form? How? Why?

Yes. $\text{S}_{\text{N}}1$ and $\text{E}1$ are ALWAYS in competition!



Challenge Problem



Can you find a set of reagents for this transformation? What competitions do you need to be concerned with?

This is a VERY difficult problem (way harder than anything on exam)
Want substitution at 1° carbon and nothing else. No reagents you know at this point would work. Hydroxide ion would give substitution at only the 1° carbon, but elimination at the 3° carbon and a β-hydrogen would be a significant concern.