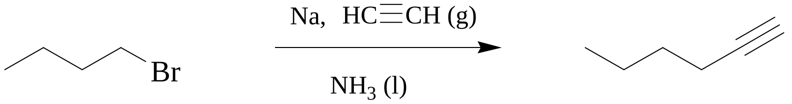
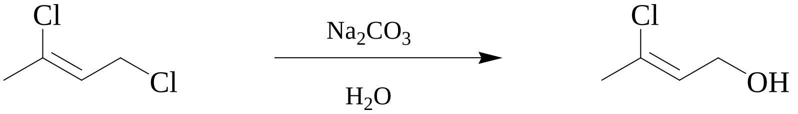
Chemistry 247B Hanson **Sample Exam 4B**

In each case, read each possible answer, use a process of elimination, and circle the BEST answer. If you are having trouble deciding between two answers, briefly explain your final choice. If you do so, use just a few words, just to clue me in to what you are thinking. Do not dwell on any particular problem for an extended period of time. Each is worth 2 points.



1. In the reaction shown above the nucleophile is

(a) Na (b) NaC≡CH (c) $HC{\equiv}C^-$ (d) HC≡CH

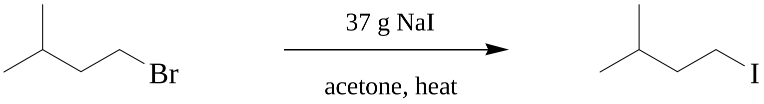


2. In the reaction shown above the nucleophile is

(a) Na_2CO_3 (b) H_2O (c) OH^- (d) CO_3^{2-}

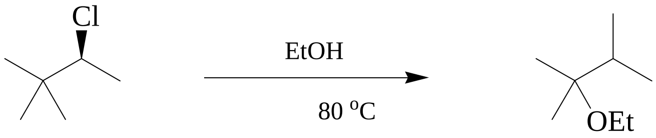
3. In the reaction shown above the function of Na_2CO_3 is

(a) to produce the OH^- needed for the reaction
(b) to absorb the Cl^- produced in the reaction
(c) to act as a strong base
(d) to act as the nucleophile



4. The reaction shown above works because

(a) sodium iodide is insoluble in acetone
(b) sodium bromide is insoluble in acetone
(c) S_N1 reactions work particularly well in nonpolar solvents
(d) bromide is a better leaving group than iodide



5. In the above reaction the nucleophile is

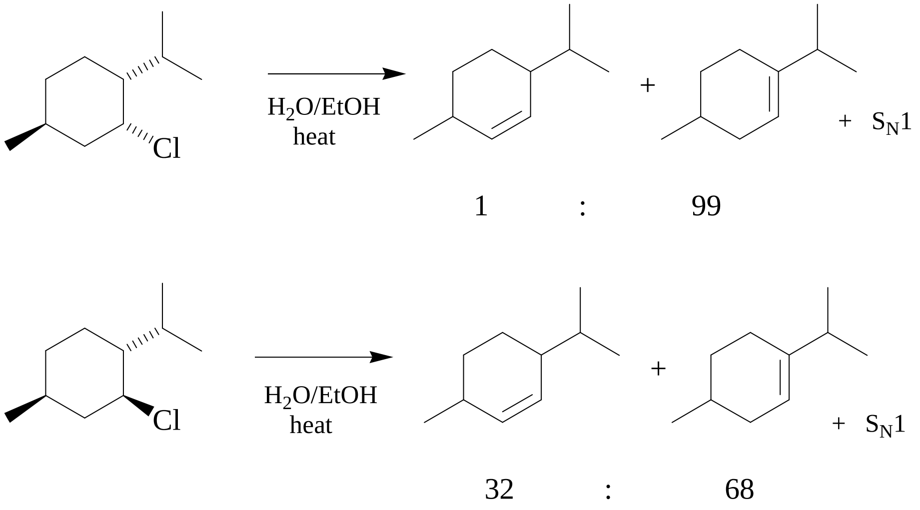
(a) Cl^- (b) CH_3CH_2OH (c) $CH_3CH_2O^-$ (d) H_2O

6. The mechanism of the above reaction is

(a) S_N1 (b) S_N2 (c) E1 (d) E2

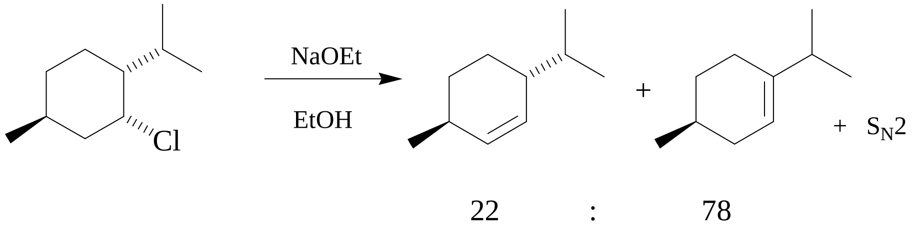
7. In the mechanism for the above reaction:

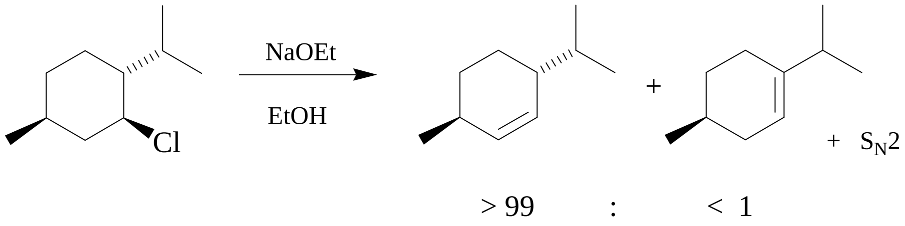
(a) There are two intermediates and three transition states
(b) There are three intermediates and three transition states
(c) There are three intermediates and four transition states
(d) There are four intermediates and four transition states



8. Comparing the two reactions above, we see that

(a) E2 eliminations can occur even without a strong base
(b) the equatorial chloride gives the better stereoselectivity in the elimination reaction
(c) in E1 reactions, the cation and anion are not always fully separated
(d) the direction of an E2 elimination in a cyclic system depends upon the stereochemistry





9. The main difference between these two reactions is that:

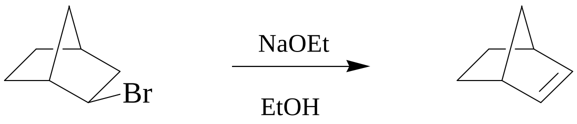
(a) In the first case, the Cl is axial, and in the second it is equatorial.
(b) In the first case, the Cl is equatorial, and in the second case it is axial.

10. The reaction that would be expected to go faster would be:

(a) The first case, because an equatorial chloride is more stable.
(b) The second case, because an equatorial chloride is more stable.
(c) The first case, because the axial chloride can undergo *anti* E2 elimination.
(d) The second case, because the axial chloride can undergo *anti* E2 elimination.

11. The reason the second reaction is so selective in terms of the alkenes produced is that:

(a) *anti* E2 elimination can only go that way.
(b) *syni* E2 elimination can only go that way.
(c) There is less chance of substitution in that case.
(d) E2 elimination is impossible, so E1 elimination occurs instead.

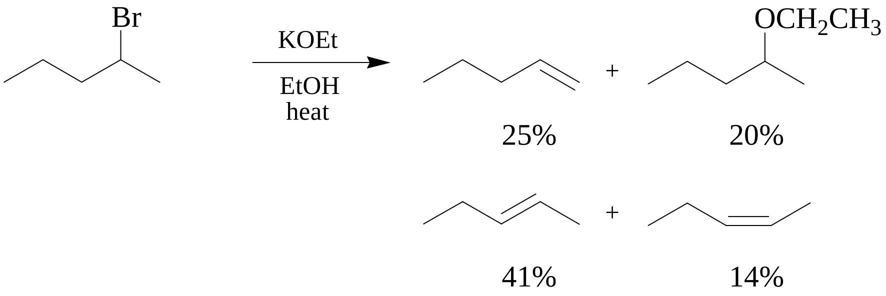


12. The mechanism of the above reaction is

(a) S_N1 (b) S_N2 (c) E1 (d) E2

13. The reason this elimination goes the direction it does is that:

(a) That is the only way you can get *anti* elimination.
(b) The reaction follows Zaitsev’s rule.
(c) The other direction would have to go through the cation.
(d) Elimination the other way would give an impossibly strained alkene.

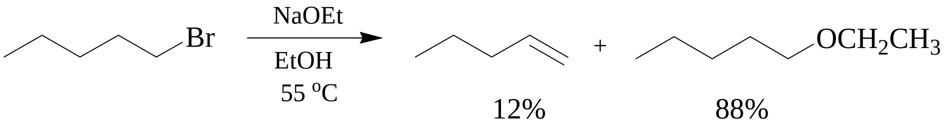


14. The major product in this case is the *trans* alkene because:

(a) That is what Zaitsev’s rule demands.
(b) The nucleophile is quite bulky.
(c) The reaction goes through an E2, not an E1, mechanism.
(d) The stability of the alkene is reflected in the transition state.

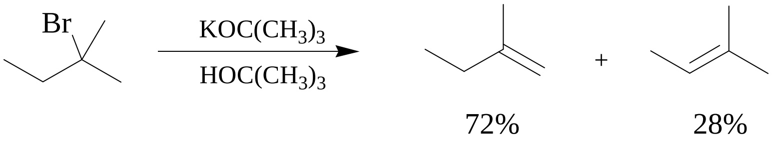
15. If the base used in this reaction were KO-*t*-Bu in HO-*t*-Bu, then:

(a) We would expect more elimination.
(b) The major product would be *cis*-2-pentene.
(c) The major product would still be *trans*-2-pentene.
(d) There would be less 1-pentene.



16. The primary lesson here is that:

(a) even with a bulky base a primary alkyl halide can give a substantial amount of substitution
(b) primary bromides primarily give substitution, even with a strong base
(c) using a protic solvent is a bad idea if what you are looking for is elimination
(d) there is no lesson here



17. The mechanism here is

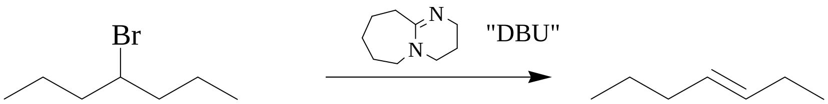
(a) S_N1 (b) S_N2 (c) E1 (d) E2

18. The primary lesson here is that:

(a) Tertiary bromides undergo E2 reactions.
(b) Use a bulky base to reduce the amount of substitution.
(c) A bulky base can result in a “violation” of Zaitsev’s rule.
(d) Disubstituted alkenes are more stable than trisubstituted alkenes.

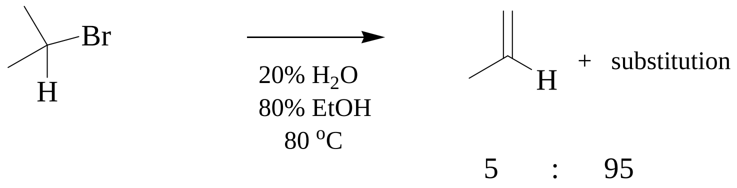
19. If NaOH in water were used instead for the base in this case we would expect:

(a) more substitution.
(b) more 2-methyl-2-pentene.
(c) more 2-methyl-1-pentene.



20. DBU is used in this reaction

(a) because it is a strong base.
(b) because it is a good nucleophile.
(c) because it is a weak base.

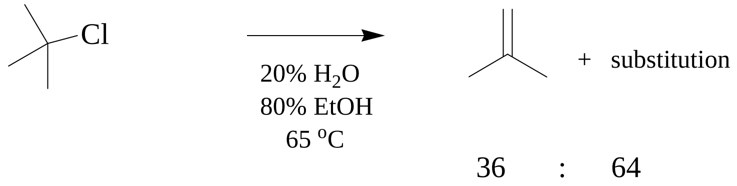


21. The mechanism of the reaction leading to the *major product* in this case is

(a) S_N1 (b) S_N2 (c) E1 (d) E2

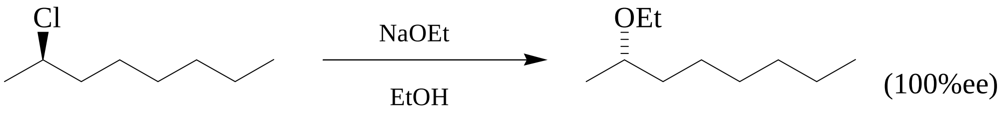
22. The reason there is so much substitution in this case is that

(a) H_2O is a good nucleophile.
(b) EtOH is a good nucleophile.
(c) the reaction is reversible.
(d) there is no reasonably strong base present.



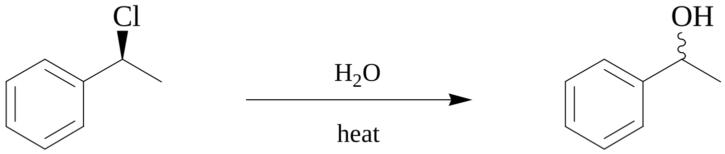
23. The reason there is less substitution in this case than in Problem 21 is that

(a) alkyl chlorides react faster than alkyl bromides.
(b) alkyl chlorides react slower than alkyl bromides.
(c) tertiary alkyl halides are less likely than secondary alkyl halides to undergo substitution.
(d) tertiary alkyl halides do not undergo S_N2 reactions.



24. The reason there is only one enantiomer produced in this case is that

(a) The nucleophile is ethoxide anion.
(b) The reaction mechanism involves only one intermediate.
(c) The reaction is stereospecific.
(d) The mechanism is S_N1.



(17%ee)

25. The low EE here reflects the fact that

(a) S_N2 reactions are not stereospecific.
(b) The reaction goes through a cation intermediate.
(c) S_N1 reactions lead to both substitution and elimination.
(d) The reaction was carried out for too long, leading to the thermodynamic product.