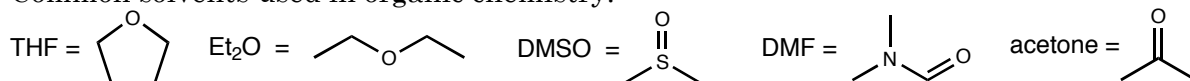


Common solvents used in organic chemistry.

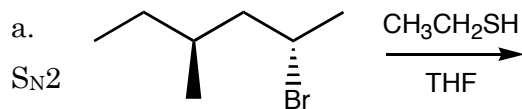


1. \_\_\_\_\_

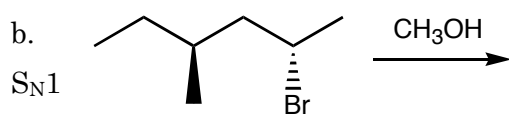
2. \_\_\_\_\_

1. (6 pts. ea.) Predict the outcome of the following reactions. Remember to use wedge and dashed bonds to indicate the stereochemical outcome of the reaction where appropriate.

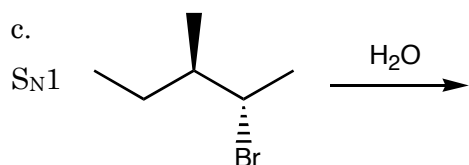
3. \_\_\_\_\_



4. \_\_\_\_\_



5. \_\_\_\_\_




7. \_\_\_\_\_

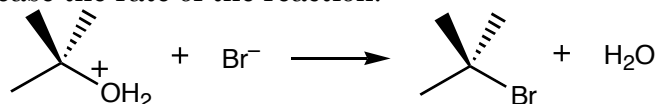
8. \_\_\_\_\_

9. \_\_\_\_\_

2. For the following pairs of molecules (a. 4 pts.) circle the nucleophilic atom, and (b. 3 pts. ea.) determine which is the better nucleophile under the given conditions.

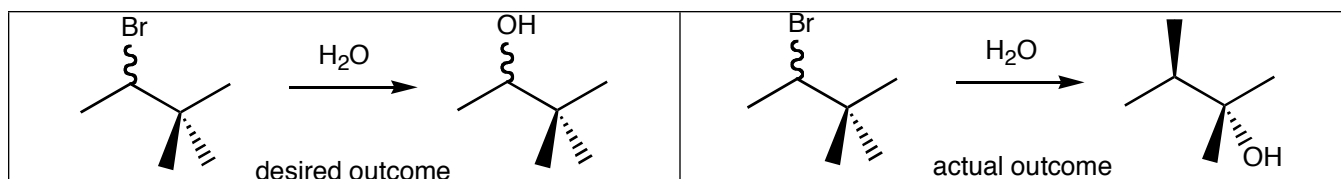
<p>CH<sub>3</sub>SNa    CH<sub>3</sub>SH</p> <p>solvent: acetone    substrate: 1-bromobutane</p>	<p>CH<sub>3</sub>SNa    CH<sub>3</sub>ONa</p> <p>solvent: THF    substrate: 1-bromobutane</p>
<p>Cl<sup>-</sup>    Br<sup>-</sup></p> <p>solvent: isopropanol</p> <p>substrate: CH<sub>3</sub>OSO<sub>2</sub>CF<sub>3</sub>            (-OSO<sub>2</sub>CF<sub>3</sub> is an amazing leaving group)</p>	<p></p> <p>solvent: THF    substrate: 2-bromobutane</p>

3. (10 pts.) Explain why increasing the concentration of the nucleophile in the following reaction doesn't increase the rate of the reaction.



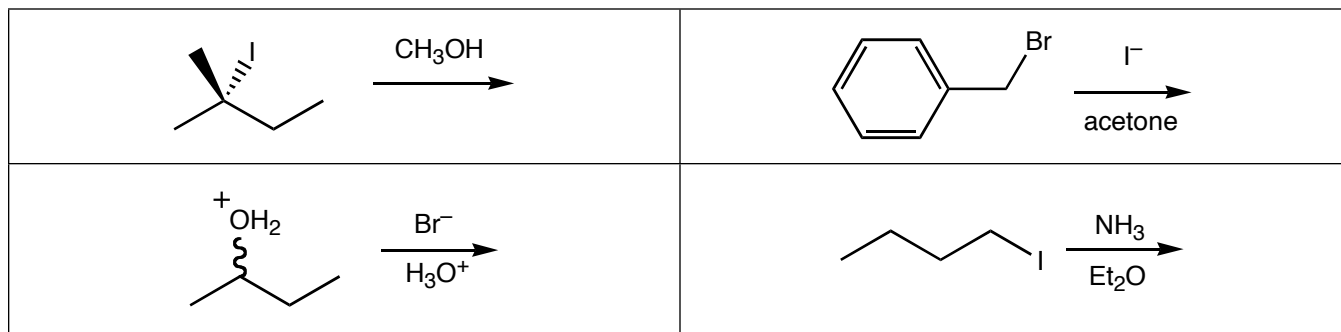
4. a. (4 pts.) Draw an  $S_N2$  reaction that shows that the stereochemistry of a chiral  $\alpha$ -C is inverted.  
 b. (3 pts.) Include the transition state as part of the reaction.  
 c. (3 pts.) Explain why the stereochemistry of the  $\alpha$ -C must be inverted.

5. (10 pts.) The synthesis of 3,3-dimethyl-2-butanol was attempted as indicated below, but 2,3-dimethyl-2-butanol was produced instead.



Draw a mechanism that explains the observed outcome of the reaction.

6. (4 pts. ea.) Determine whether the following reactions would be likely to occur via an  $S_N1$ , an  $S_N2$ , or a combination of  $S_N1$  and  $S_N2$  mechanisms.

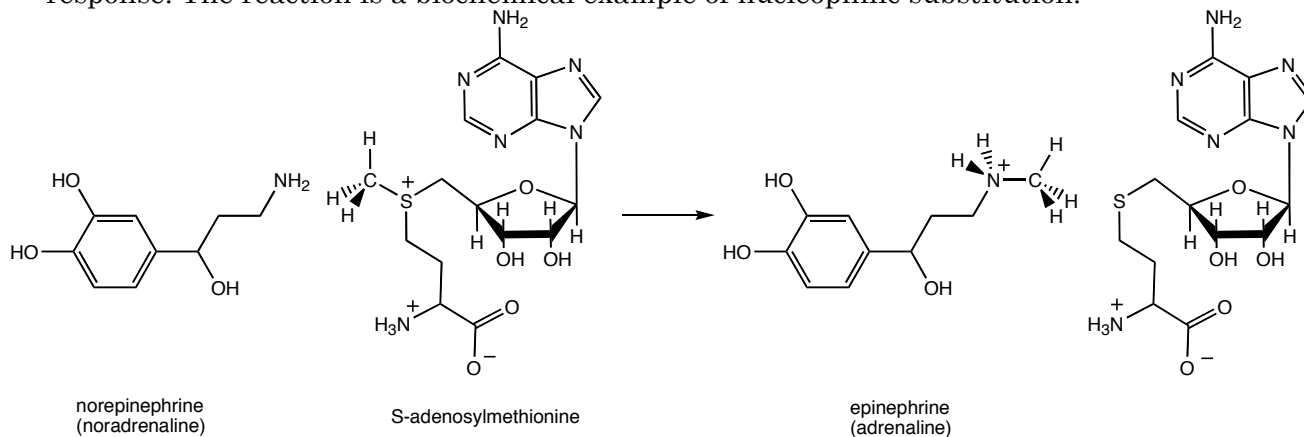


7. a. (4 pts.) What can protic solvents do that aprotic solvents cannot?

b. (4 pts.) How can protic solvents encourage carbocation formation in an  $S_N1$  reaction?

8. (8 pts.) Which is the better leaving group,  $I^-$  or  $Cl^-$ ? Explain your response.

9. With the help of an enzyme adrenaline is synthesized during the so-called "fight or flight" response. The reaction is a biochemical example of nucleophilic substitution.



a. (3 pts.) Identify the atom that acts as the nucleophile.

b. (3 pts.) Identify the leaving group.

c. (3 pts.) Is this an  $S_N2$  or  $S_N1$  reaction. Explain your choice.