Common solvents used in organic chemistry.

THF = \( \text{O} \)

2-propanol = \( \text{OH} \)

DMSO = \( \text{SO} \)

DMF = \( \text{N} \) \( \text{O} \)

acetone = \( \text{O} \)

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

a. \( \text{OH} \) \( \text{HCl} \)

b. \( \text{OH} \) \( \text{PCl}_3 \)

c. \( \text{OH} \) \( \text{HBr} \)

2. (6 pts. ea.) Predict the outcome of the following elimination reactions. List all organic products.

a. \( \text{OH} \) \( \text{OPCl}_3 \) \( \text{excess NEt}_3 \)

b. \( \text{OH} \) \( \text{H}_2\text{SO}_4, \text{H}_3\text{PO}_4 \) \( \Delta \)
3. (6 pts. ea.) Predict the outcome of the following substitution reactions. Ignore stereochemistry.
   a. 
   
   b. 
   
   c. 

4. The reaction of HCl with the cyclic ether on the left fails, yet it succeeds with the cyclic ether (the epoxide) on the right.
   
   a. (6 pts.) Explain why the lefthand reaction fails.
   
   b. (6 pts.) Explain why the righthand reaction succeeds.

5. a. (4 pts.) Circle the leaving groups on the following molecules.
   
   b. (4 pts.) Determine which of the following molecules has the better leaving group (place a star next to the molecule).
   
   ![Chemical structures]
6. (12 pts.) Determine the mechanism that is most likely to predominate (S_N1, E1, S_N2, or E2) under the following reaction conditions.

7. (10 pts.) A mass spectrum of CH_3CH_2CH_2CH_2Cl is presented below. Identify (draw) the structures of the fragments that give rise to the peaks at m/z = 43 and 57.

8. (10 pts.) To the right is a mass spectrum of 1-bromopentane. The molar mass of 1-bromopentane is 151.04 g Explain why there isn’t a significant peak with an m/z = 151, but there are significant peaks with m/z = 150 and 152.