

1. (6 pts. each) Predict the products of the following reactions, include the relative yields for each of the products (ignore stereochemistry). The following numbers might be useful: 5:3.8:1, 1600:82:1.

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

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

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

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

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

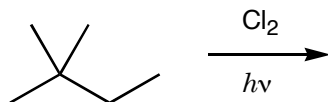
6. \_\_\_\_\_

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

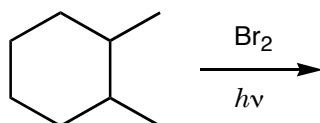
8. \_\_\_\_\_

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

a.



b.



2. A chemist needs to make a primary alkyl halide from 2-methylpropane.

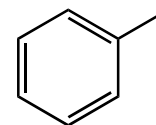
a. (8 pts.) Should the chemist use  $\text{Cl}_2$  or  $\text{Br}_2$ ? Explain.

b. (4 pts.) Draw 2-methylpropane.

c. (4 pts.) Draw the primary alkyl halide formed in this reaction.

3. Both toluene and methylcyclohexane undergo radical substitution reactions with  $\text{Br}_2$ .

a. (8 pts.) Draw the most likely products for each of the reactions.

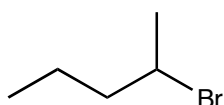


toluene

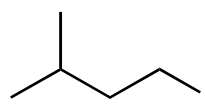
b. (6 pts.) Explain why toluene reacts more quickly than methylcyclohexane.

4. (2 pts. each) Identify whether the following alkyl halides react via an  $\text{S}_{\text{N}}1$  and/or an  $\text{S}_{\text{N}}2$  mechanism.

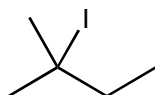
a.



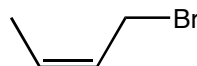
b.



c.



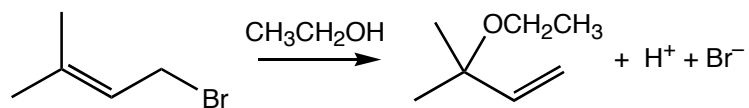
d.



5. a. (4 pts.) To encourage a reaction to proceed via an  $\text{S}_{\text{N}}2$  the solvent should be protic or aprotic, explain.

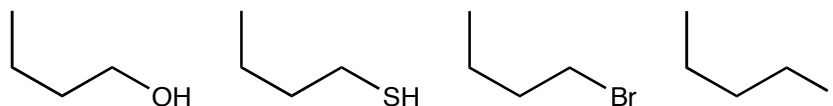
b. (4 pts.) Provide an example of a protic solvent.

6. (8 pts.) Draw a mechanism that explains how the product forms in the following reaction.

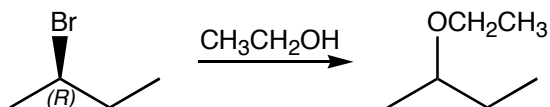


7. a. (4 pts.) Identify the molecule with the best leaving group.

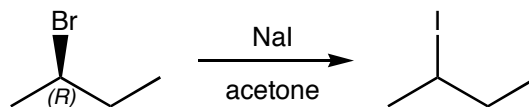
b. (4 pts.) Identify the molecule with the worst leaving group.



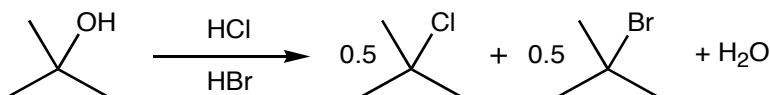
8. a. (6 pts.) In lab, you performed the following reaction. If you had started with *R*-2-bromobutane, what would the configuration of the product be? Explain your response.



b. (6 pts.) In lab, you performed the following reaction. If you had started with *R*-2-bromobutane, what would the configuration of the product be? Explain your response.



9. (8 pts.) In lab, you performed the following reaction.



Under these conditions, bromide is a better nucleophile than chloride. Explain then, why the product is a 50:50 mixture of the two alkyl halides.