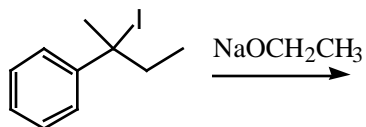
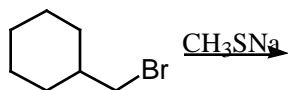
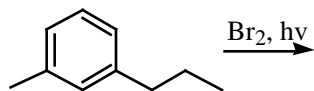
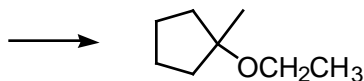


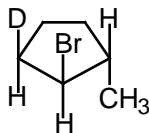
1. Predict the major organic product for each of the following. (3 points each)



2. Show an alkyl bromide and some nucleophile that you could use to make the following by $\text{S}_{\text{N}}2$. (3 points)



3. For the structure shown, (3 points each)
a. Draw the major elimination product formed upon treatment with $\text{H}_2\text{O}/\text{heat}$.



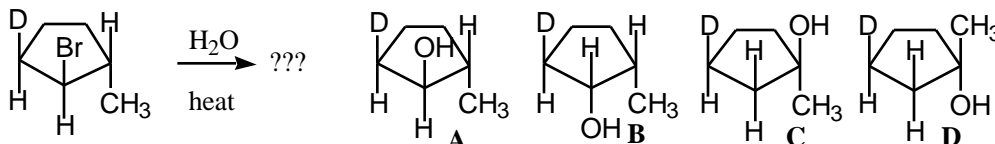
b. Draw the major elimination product formed upon treatment with $\text{CH}_3\text{CH}_2\text{ONa}$.

c. Draw the major substitution product formed upon treatment with $\text{CH}_3\text{CH}_2\text{ONa}$.

(3 points for each multiple choice question)

4. Which of the following is true regarding an S_N1 reaction?
- It would be faster at 25° than 50°
 - It would be faster in ethanol than in pentane
 - Keeping the moles of reactants constant but doubling the quantity of solvent would decrease the rate by a factor of 4.
 - Stereochemical inversion occurs exclusively
6. Which of the following statements is true?
- The rate determining step is always the last step in a reaction mechanism.
 - The stability/reactivity principle says that the more stable of two chemicals will be more reactive
 - The reactivity/selectivity principle says that the more reactive of two chemicals will be less selective.
 - The activation barrier for a reaction is the difference in energy between reactants and final products.
7. Which of the following statements is true about the chlorination of methane?
- In each propagation step a radical is produced
 - 6.02×10^{23} initiation events are needed to make one mole of chloromethane
 - Most chloromethane is made by combination of a methyl radical with a chlorine radical
 - The overall chlorination of methane is strongly endothermic.
8. Which of the following statements is FALSE?
- Optically active solutions always contain chiral molecules.
 - Two diastereomers always have identical melting points
 - Optically inactive solutions are either racemic or else contain no chiral chemicals at all
 - A solution with 60% optical purity would have an 80/20 mix of enantiomers

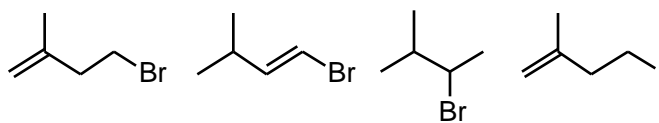
9. When the reactants shown undergo substitution, which of the products A-D will form? (3 points)



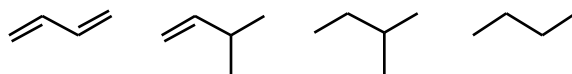
- A only
- B only
- A and B
- A, B, and C
- A, B, C, and D

10. Rank the reactivity of the structures shown toward the reactant(s) indicated on the left (1 being most, etc.) (3 points each)

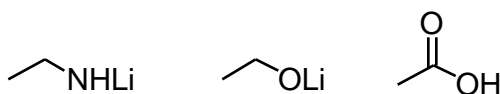
NaOCH₂CH₃



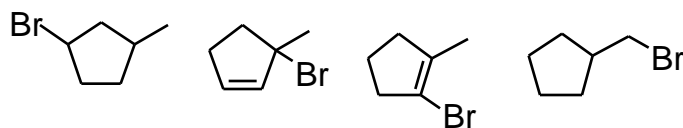
Br₂/hν



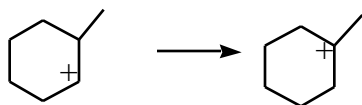
CH₃Br



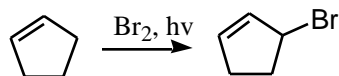
H₂O, heat,
catalytic H⁺



11. Carbocations often rearrange, as shown below. Draw in the hydrogens on the two carbons involved in the rearrangement, and show formal arrow-pushing to illustrate the transformation. (3 points)

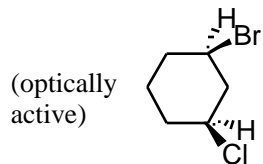


12. Draw the mechanism for the following reaction, propagation steps only. (4 points)

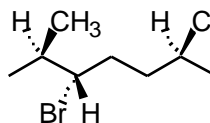
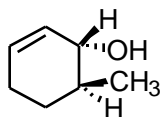


13. Draw (3R,6R)-6-bromo-3-chloro-2-methyloctane (3 points)

14. Name the following: (3 points)



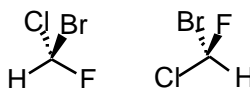
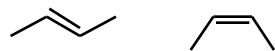
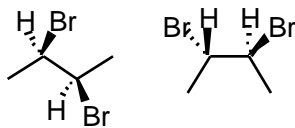
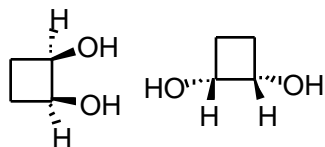
15. Classify each of the chiral carbons in the following structures as R or S (there may be more than one in a molecule). (10 points)



16. a. Classify each pair as diastereomers, enantiomers, or same. (12 points)

b. For the first structure of each pair, circle it if it is **not chiral**

c. For the first structure of each pair, write "meso" by it if it is meso



17a. a) Draw all the unique stereoisomers of 2,3-dichlorobutane. Cross out any duplicates.

b) Identify which is meso. c) Identify a pair that are related as diastereomers. (5 points)

18. Draw the mechanisms for the following reactions, using formal arrow pushing. Note: in some case hydrogens that are not illustrated will be involved in bond changes. You would do well to write them in at the beginning. (12 points total, 3/3/6 distribution)

