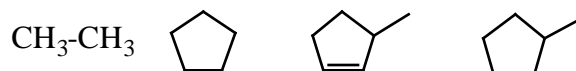
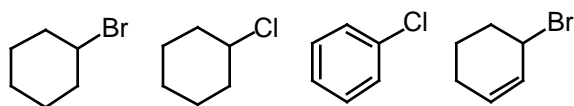


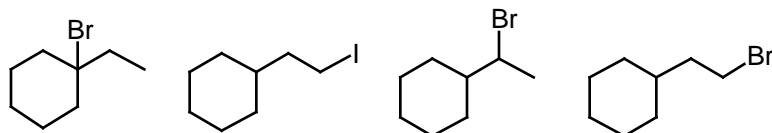
1. Rank the reactivity of the following molecules toward $\text{Br}_2/\text{h}\nu$. (1 most, 4 least) (3 points)



2. Rank the reactivity of the following molecules toward ethanol and AgNO_3 . (1 most, 4 least) (3 points)



3. Rank the reactivity of the following molecules toward NaOCH_3 . (1 most, 4 least) (3 points)

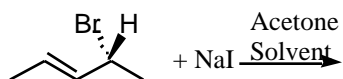
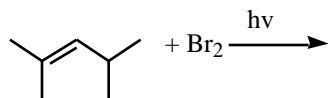
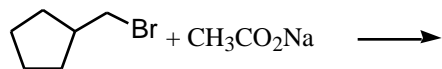


4. Rank the reactivity of the following toward 1-iodopropane. (1 most, 4 least) (3 points)

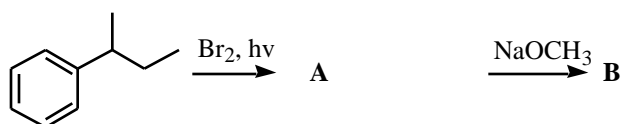


5. What is the hybridization of a carbocation? (2 points)

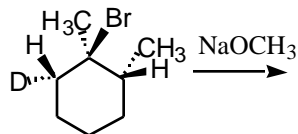
6. Predict the major organic product (1 major structure is all that is needed in each case) for each of the following reactions. (Minor products or inorganic side products need not be drawn.) (3 points each)



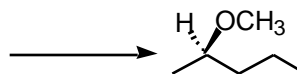
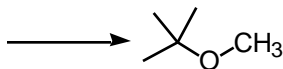
7. Draw the structures for intermediate **A** and final product **B**. (4 points)



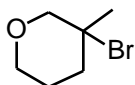
8. Draw the product when the following substance undergoes E2 elimination. ("D" is deuterium, basically just a labelled hydrogen). If the starting material is optically active, will the product be optically active? (4 points)



9. Show an alkyl bromide and some nucleophile that you could use to make the following by S_N2 . (3 points each)

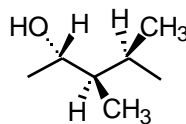
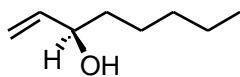
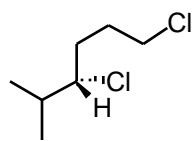


10. Draw all possible elimination products that could form from the following reactant. (5 points)



11. Which of the following would not increase the rate of an $E1$ reaction? (3 points)
- an increase in temperature
 - an increase in the "activation energy"
 - an increase in the concentration of the alkyl halide
 - an increase in the stability of the carbocation intermediate
12. When comparing the reaction of 2-methylpropane with either $Cl_2/h\nu$ or $Br_2/h\nu$, which of the following statements is true? (3 points)
- bromine is less reactive and more selective
 - chlorine is less reactive and more selective
 - bromine is more reactive and more selective
 - chlorine is more reactive and more selective
13. Which of the following statements is true relative to reactions I-III: (3 points)
- | | |
|-----|--|
| I | $CH_4 + Br\cdot \longrightarrow CH_3\cdot + HBr$ |
| II | $CH_3CH_3 + Br\cdot \longrightarrow CH_3CH_2\cdot + HBr$ |
| III | $CH_3CH_2CH_3 + Br\cdot \longrightarrow (CH_3)_2CH\cdot + HBr$ |
- I has the smallest energy of activation and the highest energy transition state
 - II has the smallest energy of activation and I has the lowest energy transition state
 - III has the largest energy of activation and the highest energy transition state
 - III has the smallest energy of activation and the lowest energy transition state

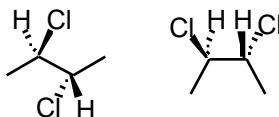
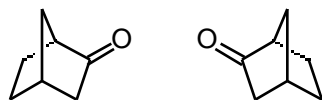
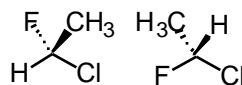
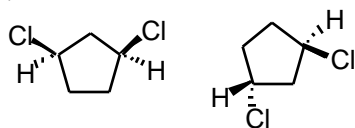
14. Classify each of the chiral carbons in the following structures as (R) or (S). (10 points)



15. a. Classify each pair of molecules as diastereomers, enantiomers, or same. (12 points)

b. Circle any molecules that are chiral

c. Write "meso" by any structures that are meso

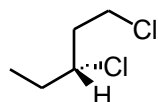


16. Which of the following statements is true? (3 points)

- All solutions with chiral molecules are optically active
- All molecules with chiral carbons are chiral
- A solution that has 50% optical purity has a 50/50 mixture of enantiomers
- Two enantiomers always have identical boiling points

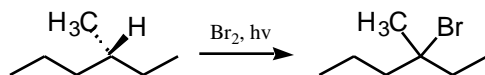
17. Draw (2R,3S)-2-bromo-3-chlorohexane (3 points)

18. Name the following: (3 points)



19. a) Draw all unique stereoisomers of 2,4-dibromopentane. Label each with a letter, A, B, etc.. Cross out any duplicates. (8 points)
b) Identify any that are chiral
c) Identify any that are meso

20. a) Draw the mechanism for the following reaction. (Draw the propagation steps only.) (4 points)
b) Is your product chiral, and if so is it optically active? (1 points)



21. a) Draw the mechanism for the following reaction. (4 points)
b) Identify the slow step. (1 point)

