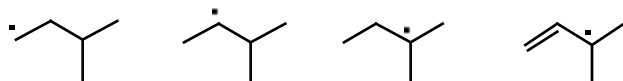
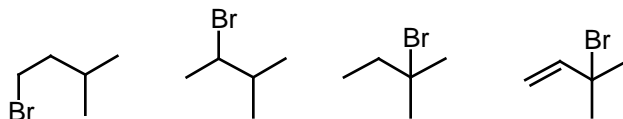


1. _____ /4	6. _____ /9	11. _____ /6	16. _____ /4
2. _____ /4	7. _____ /4	12. Removed	17. _____ /6
3. _____ /4	8. _____ /6	13. _____ /6	18. _____ /16
4. _____ /4	9. _____ /10	14. _____ /6	Total _____ /100
5. _____ /3	10. _____ /6	15. _____ /2	

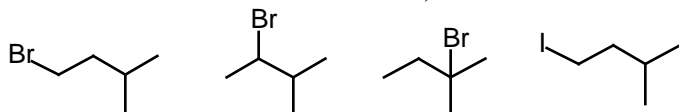
1. List the following radicals in order of increasing stability (from most stable **1** to least stable **4**)



2. List the following alkyl halides in order of decreasing reactivity toward  $S_N1/E1$  reactions (from most reactive **1** to least reactive **4**).



3. List the following alkyl halides in order of decreasing reactivity toward  $S_N2$  reactions (from most reactive **1** to least reactive **4**).



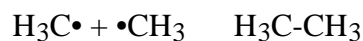
4. Rank the bond strength of the following (from strongest **1** to weakest **4**).



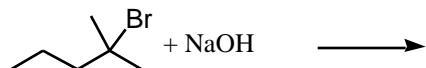
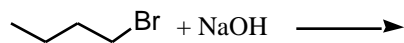
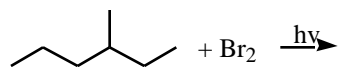
5a. Put a **1** by the reaction for which  $H^\circ = E_{act}$ . ( $E_{act}$  = activation energy)

b. Put a **2** by the reaction for which  $E_{act} = 0$ .

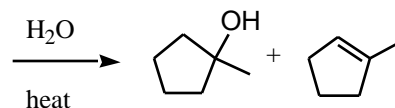
c. Put a **3** by the reaction for which  $E_{act} > H^\circ$ .



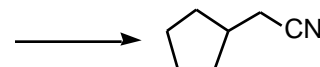
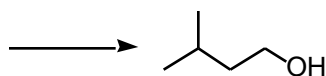
6. Predict the major organic product for each of the following reactions. (Minor products or inorganic side products need not be drawn.)



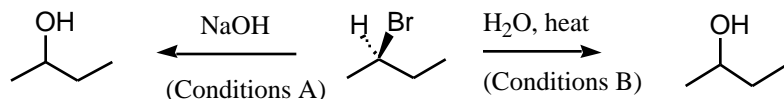
7. Show the Starting Alkyl Bromide which gave the following products.



8. Show an alkyl bromide and some nucleophile that you could use to make the following. (I don't care whether you specify a nucleophile just as the anion  $Z^-$  or as  $NaZ$  with a metal counterion.)



9. Optically active (R)-2-bromobutane can be converted to 2-butanol under either conditions A or conditions B. Describe the stereochemistry of the product solutions for the two different conditions.

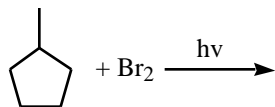


Conditions A

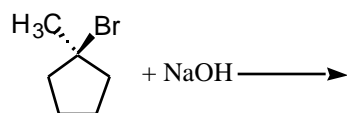
Conditions B

- Alcohol is Chiral or Achiral?
- Optically Active or Not?
- (R), (S), or both?
- Reaction occurred by Inversion, Retention, or Racemization?
- What happens to the rates if you double the concentrations of all reactants?

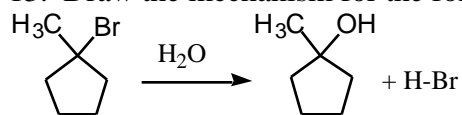
10. Draw the major product for the following reaction. Then draw the mechanism for its formation. (Draw the propagation steps only.) Is your product chiral? (You may need to add relevant hydrogens.)



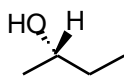
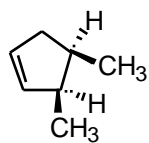
11. Draw the major product for the following reaction. Then draw the mechanism for its formation. (You may need to add relevant hydrogens.)



13. Draw the mechanism for the following reaction. (Don't worry about designating stereochem.)



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



15. Draw (R)-2-bromopentane

16. Draw *meso*-1,3-dichlorocyclopentane, and mark the chiral C's as (R) or (S).

17. Draw all of the different isomers of 2,3-dichlorobutane, identify each as either chiral or *meso*, and classify the relationship between each two as enantiotopic or diastereotopic. (You may use Fischer projections or zig/zag/hash/wedge pictures, as you please. (If two are the same, cross one of them off your list.)

18. Classify the pairs of molecules as diastereomers, enantiomers, or same. For the first molecule in each pair, circle it if it is chiral. For the second molecule in each pair, put a \* next to each chiral C.

