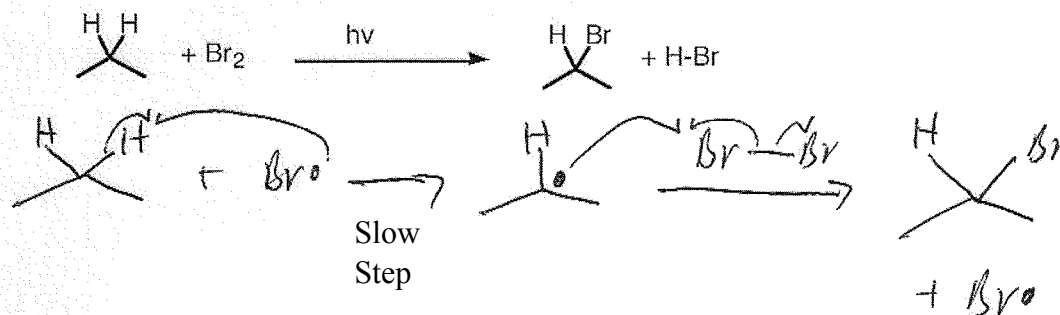
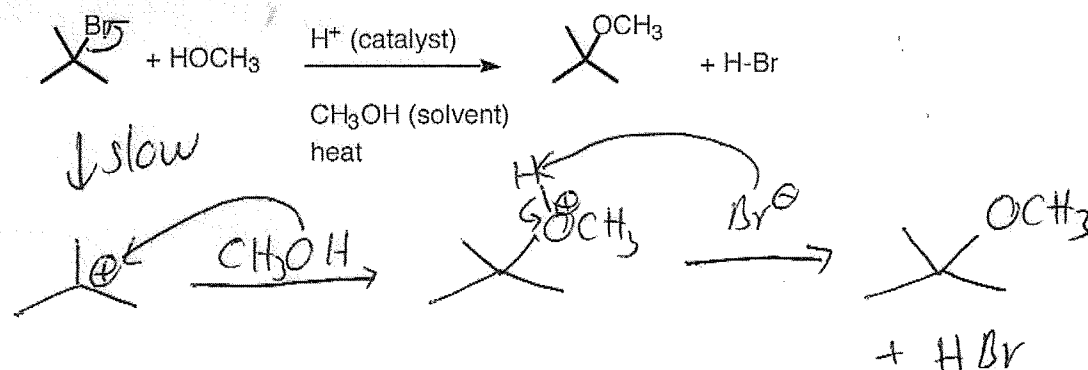


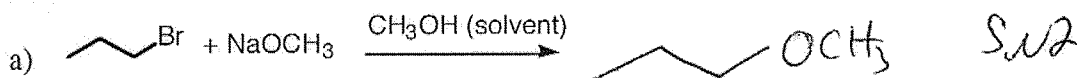
1. Draw the mechanism for the following reaction, and write "slow" next to the rate-determining step. Be sure to draw all intermediates, and to correctly draw "electron-movement" arrows or half-arrows. (Show the propagation steps only.) (4 points)

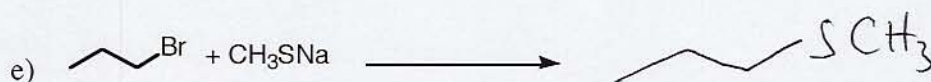
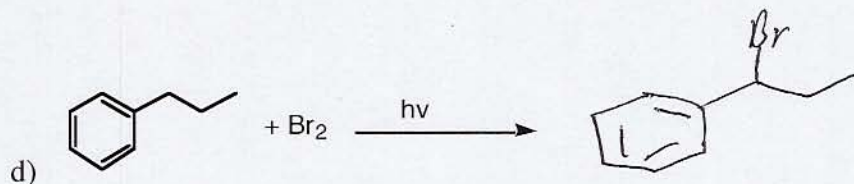
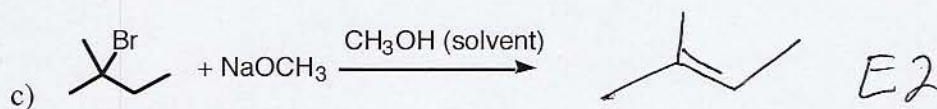


2. Draw the mechanism for the following reaction, and write "slow" above the rate-determining step. Be sure to draw all intermediates, and to correctly draw "electron-movement" arrows. (5 points)

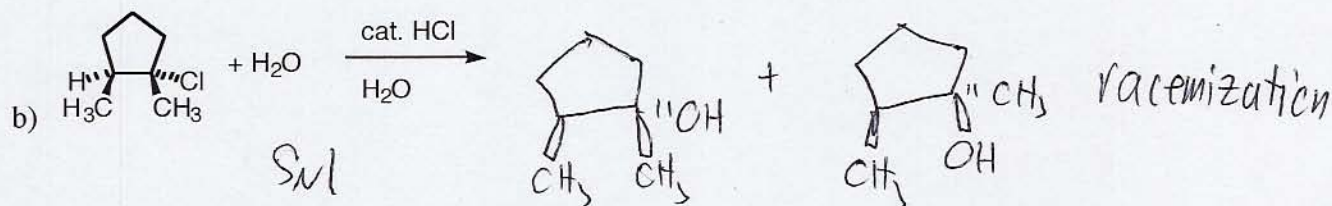
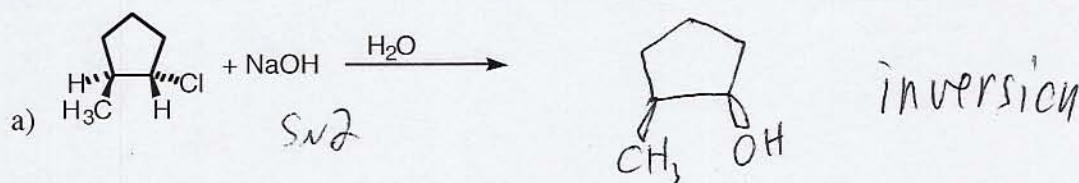


3. Predict the major products for the following reactions. (4 points each)

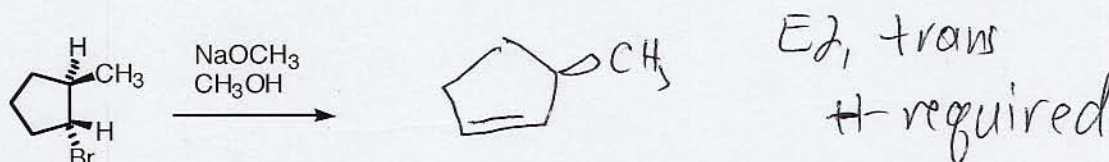




4. Draw the substitution products for the following reactions. (Do not draw the accompanying elimination products). Include stereochemistry in your answer, and if two substitution products are formed draw them both. (4 points each)



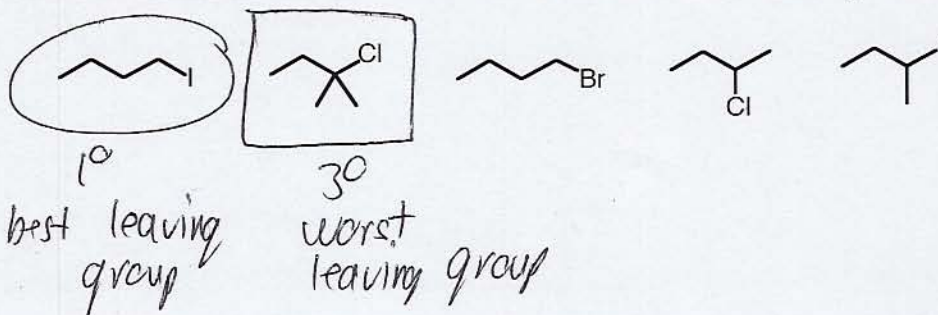
5. Draw the E2 elimination product(s) [do not draw the substitution product(s)]. (4 points each)



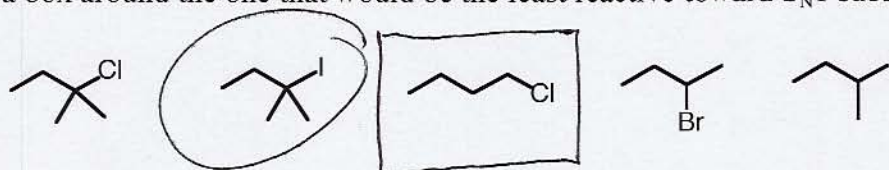
6. Of the following alkyl halides, (3 points)

a) Circle the one that would be the most reactive toward $\text{S}_{\text{N}}2$ substitution

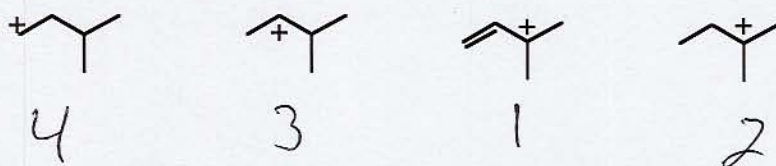
b) Put a box around the one that would be the least reactive toward $\text{S}_{\text{N}}2$ substitution



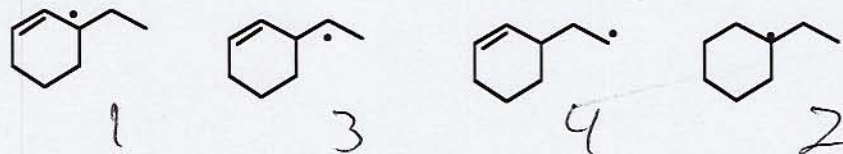
7. Of the following alkyl halides, (3 points)
 c) Circle the one that would be the most reactive toward S_N1 substitution
 d) Put a box around the one that would be the least reactive toward S_N1 substitution



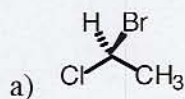
8. Rank the stability of the following carbocations, from 1 (most stable) to 4 (least stable) (4 pts)



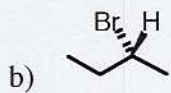
9. Rank the stability of the following radicals, from 1 (most stable) to 4 (least stable) (4 pts)



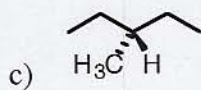
10. Classify as R or S (2 pts each)



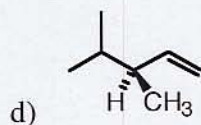
S



R



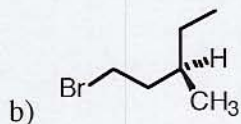
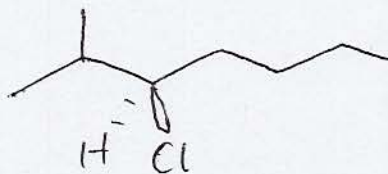
achiral, no R or S



S

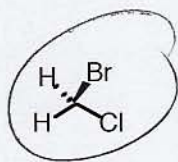
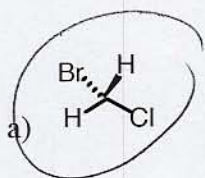
11. Provide the structure and the IUPAC name for the following (3 pts each)

a) (R)-3-chloro-2-methylheptane

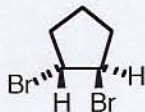
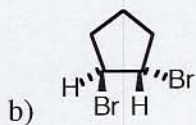


(R)-1-bromo-3-methylpentane

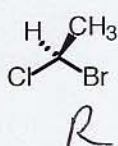
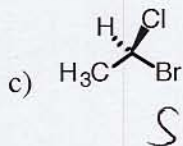
12. Classify the pairs of molecules as not isomers, structural isomers, diastereomers, enantiomers, or identical, and circle any molecules that are achiral. (2 pts each)



same (achiral)



enant



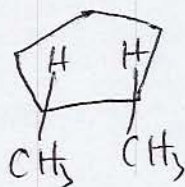
enant

13. For 1,2-dimethylcyclopentane, (8 pts)

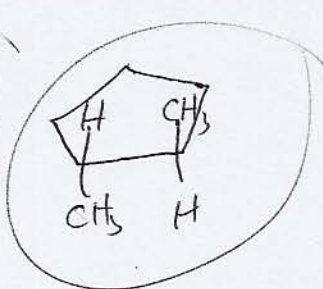
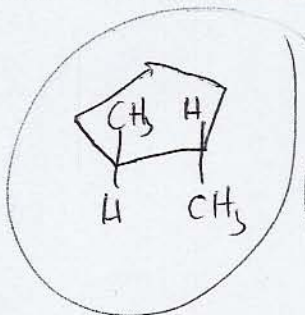
a) How many stereocenters are present

2

b) Draw all the possible stereoisomers, and circle those that are chiral.

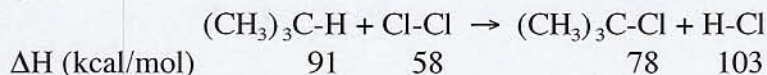


meso



Each of the following multiple choice problems is worth 3 points.

14. For the reaction shown below, with bond dissociation energies listed below each key bond, the overall ΔH is:

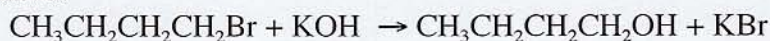


- a) +58 kcal/mol
- ☒ b) -32 kcal/mol
- c) +32 kcal/mol
- d) -57 kcal/mol
- e) +181 kcal/mol

15. Which factor would not increase the rate of an E1 reaction:

- a) Use of a more polar solvent
- b) Use of a 3° rather than a 2° alkyl halide
- ☒ c) Doubling the concentration of the base
- d) Using iodide rather than bromide as leaving group

16. Consider the $\text{S}_\text{N}2$ reaction shown below. Assuming no other changes, what effect on the rate would simultaneously doubling the concentrations of both 1-bromobutane and KOH have?



- a) No effect
- b) It would double the rate
- c) It would triple the rate
- ☒ d) It would increase the rate by four times
- e) It would increase the rate six times

17. Of the $\text{S}_\text{N}1/\text{S}_\text{N}2/\text{E}1/\text{E}2$ reactions, rearrangements are likely to occur in:

- a) $\text{S}_\text{N}1$ reactions only
- b) $\text{S}_\text{N}2$ reactions only
- c) E1 reactions only
- ☒ d) Both $\text{S}_\text{N}1$ and E1 reactions
- e) Both $\text{S}_\text{N}2$ and E2 reactions