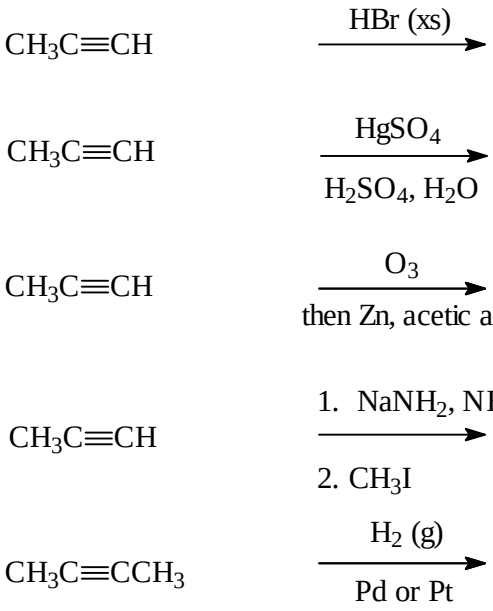
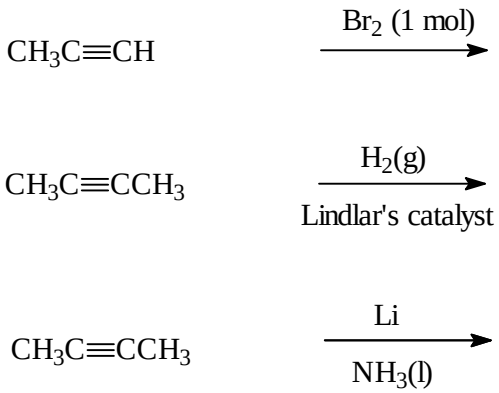
Chemistry 211 ***Name*_____**

Test 4 (Chapters 8, 9 & 10) ***June 11, 2009*** ***60 points***

1. (16 points) Draw the structure of the major organic product of each of the following. Show the stereochemistry of the product in the last three reactions.



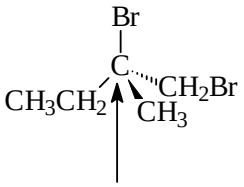
(indicate the stereochemistry of the products of the next three reactions)

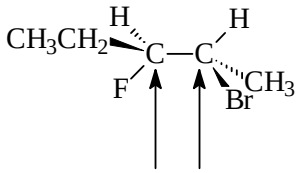


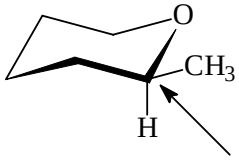
2. (4 points) Devise a reasonable synthesis of butanal ($CH_3CH_2CH_2\overset{\overset{O}{\|}}{C}H$) using ethyne (acetylene) as the only source of carbon atoms (i.e., ethyne must provide all carbon atoms in the product) and using any other chemicals needed. Be sure to indicate all reagents and conditions required for each step.

3. (2 points) Write the correct IUPAC name for this structure: $CH_3CH_2C{\equiv}CCH_2CH_2CH(CH_3)CH_3$

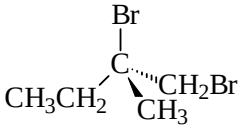
4. (4 points) Determine the R or S configuration of each of the chirality centers indicated with an arrow.

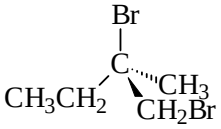


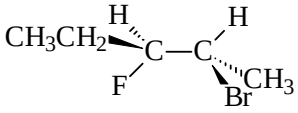


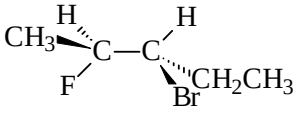


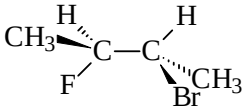
5. (8 points) Write the appropriate letter on the line beside each pair of structures to indicate their relationship as: **C**onstitutional isomers (**C**), **D**iastereomers (**D**), **E**nantiomers (**E**), **I**dentical (**I**), or **N**one of the above (**N**). Circle every **meso form.**

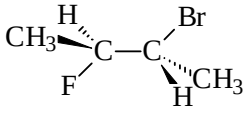
____ 

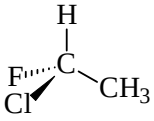
and 

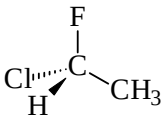
____ 

and 

____ 

and 

____ 

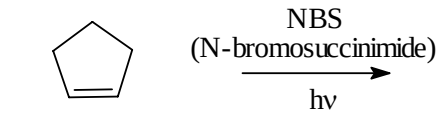
and 

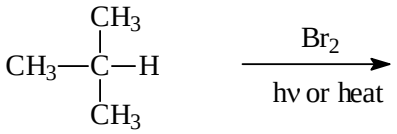
6. (2 points) Calculate the <u>maximum number of stereoisomers possible</u> for a compound that has 4 chirality centers. (A correct formula will suffice.)

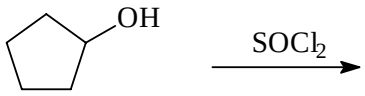
7. (4 points) When a new chirality center is formed in a chemical reaction between achiral reactants, the product(s) of this reaction must either be a _____ or a _____. (More than one word may be used in each answer.)

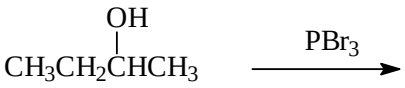
8. (2 points) Enantiomers differ from one another by only one physical property, namely _____ _____.

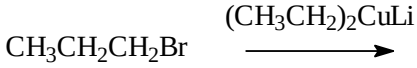
9. (10 points) Draw the structure of the major organic product of each of the following reactions:





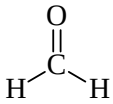






10. (4 points) Draw the mechanism of the reaction of addition of bromine (Br_2) to *cis*-2-butene. Show the structure of the intermediate. Be sure to indicate completely (with dashed lines and wedges) the stereochemistry of the each product that is formed. If more than one product is formed, name the stereochemical relationship between the products.

11. (2 points) Circle the structure below that has the highest oxidation state of carbon; underline the structure that contains the lowest oxidation state of carbon.



CCl_4 CH_3NH_2 CH_4