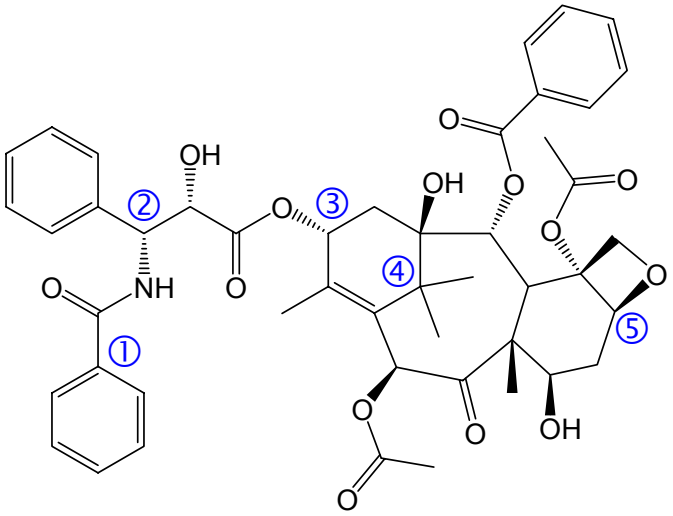
Chem 221 W08 Sect 52 Dr. C. Rogers **NAME:**

INTRODUCTORY ORGANIC CHEMISTRY I --- **PROBLEM SET #2**

INSTRUCTIONS: ANSWER ALL QUESTIONS ON THESE PAGES. HAND IN (stapled, with no extra pages please) **AT THE BEGINNING OF CLASS on Thursday March 20**. LATE SUBMISSIONS WILL **NOT** BE ACCEPTED (EARLY IS FINE). ALL MATERIAL CAN ALL BE FOUND IN THE CLASS NOTES and/or IN BRUICE CHAPTERS 1-7, 11.

 # 1. The anti-cancer drug Taxol is shown below (recall Problem Set #1). For more about Taxol, and to view this molecule in 3-dimensions, go to: http://www.3dchem.com/molecules.asp?ID=34# This time, your task involves considering the stereochemical aspects of Taxol.

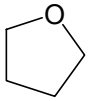
Your tasks: (i) Determine if the numbered C atoms are asymmetric, & if so, label with a *.
(ii) Label each numbered asymmetric C atom with its R/S configuration.
(iii) Determine the E/Z configuration of the alkene unit.
(iv) Label the molecule as chiral or achiral.
(v) Calculate the total # of stereoisomers this molecule could have. Explain briefly.



 # 2. You wish to do a chemical reaction involving the phenyl acetylide anion, $C_6H_5–C{\equiv}C^-$, so you plan to treat phenyl acetylene $C_6H_5–C{\equiv}CH$ with sodium amide ($NaNH_2$).

a) Will you need to take precautions to remove traces of water from your solvent before adding your reagents? Why or why not?

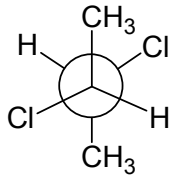
b) Which solvent would be better to use, and why? Ethanol (CH_3CH_2OH) *or* tetrahydrofuran ?



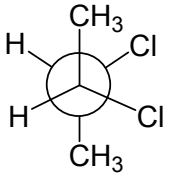
 # 3. The Newman projections below represent (R,R)- , (S,S)- and (R,S)-2,3-dichlorobutane.

a) Which is which?

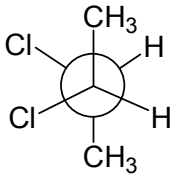
b) Which compound is a meso compound? Explain briefly.



I

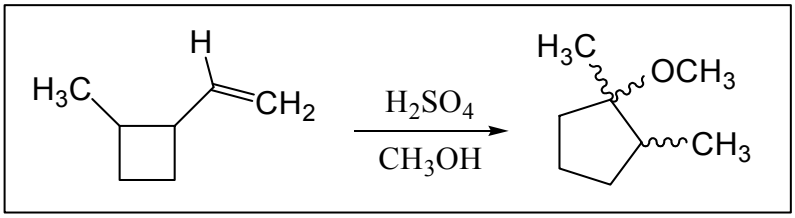


II



III

 # 4. Write a step-by-step "arrow-pushing" mechanism to explain the following reaction product.



note: ≀ means mixture of both configurations at that position

 # 5. There are four dimethylcyclopropane isomers.

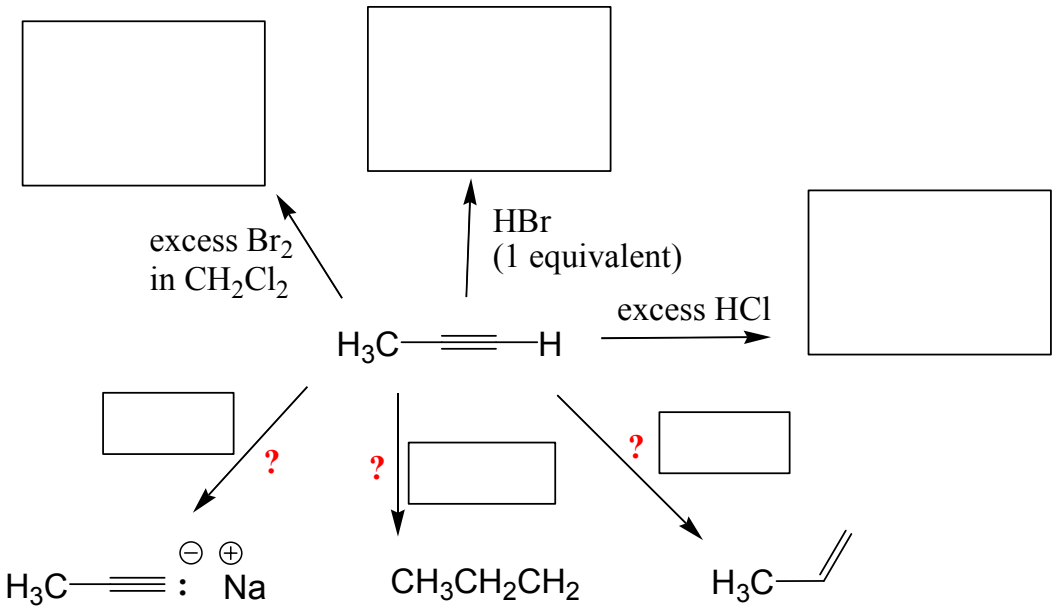
a) Draw perspective drawings (3-dimensional) for these isomers.

b) Circle the isomers that are chiral.

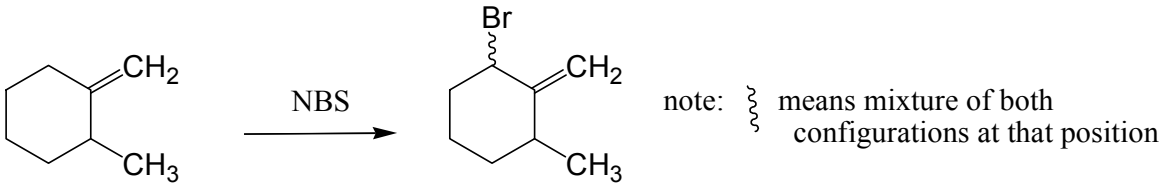
c) If a mixture of 1 mole of each of these isomers were subjected to simple gas chromatography (which separates compounds based on their boiling points), how many fractions would be obtained? Which compounds would each fraction contain?

d) How many of these fractions would be optically active? Explain briefly.

 # 6. Like alkenes, alkynes undergo electrophilic addition reactions. For example, hydrogen halides, halogens and hydrogen can all be added across the C≡C, with results that we can predict using the same mechanistic thinking we used for alkenes (note: addition of water & ROH are a little more complex). Because there are 2 π-bonds, however, we must be careful to control how much of our electrophilic reagent we use, and sometimes make other modifications. On your own, refer to Bruice Ch.6 sections 6.5, 6.6, 6.9 & 6.10 to learn how to correctly choose the missing reagents and products (with stereochemistry) for the reactions of 1-propyne shown below.



 # 7. The following reaction is unlikely to give a high yield of the product shown. Draw the product(s) that would actually form in greater yield, and briefly explain why this would happen.



 # 8. Draw line structures of the major product(s) of the reactions below. For each, also include:

i. the expected stereochemistry (*i.e.,* draw dashes/wedges for all asymmetric centres)

ii. a few keywords about the mechanism that explain the stereochemistry (*e.g.,* C+ intermediate, concerted syn addition, radical intermediate, anti addition, *etc.*).