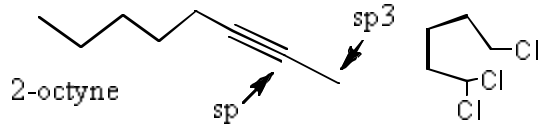
Chemistry 2203/7 ('09) **ANSWERS TEST 2A** **Name: ___ABENOR_____ Page1/1**
Marks are in parentheses

1. (7) For the molecules below, provide a systematic name (*2 x 2 marks*) and indicate the hybridization state of the atoms indicated by an arrow (*2 mark*); What is the degree of unsaturation of the alkyl halide? *Show calculation*. (1 mark)



1,1,5- trichloropentane

Deg of unsat = 12- [(9 +3)]/2 = 0

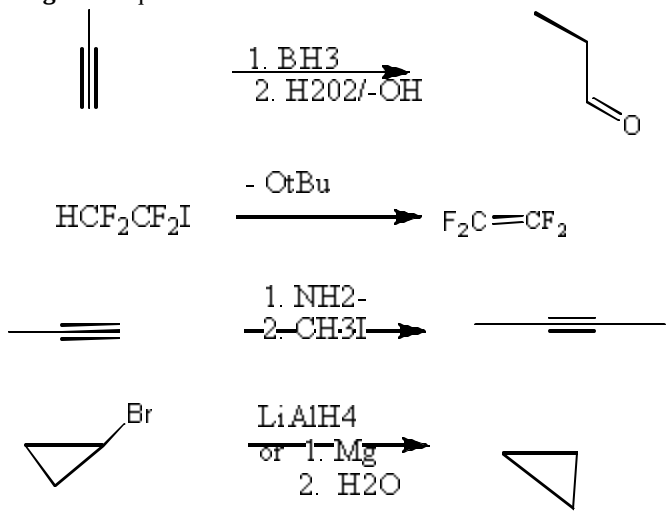
2a. (2) Why does CH_3-C=C-CH_3 have a higher melting pt (stacks better) than CH_3-CH_2C=C-H?

Greater symmetry of 2-butyne (mirror plane bisects the triple bond) relative to 1-butyne

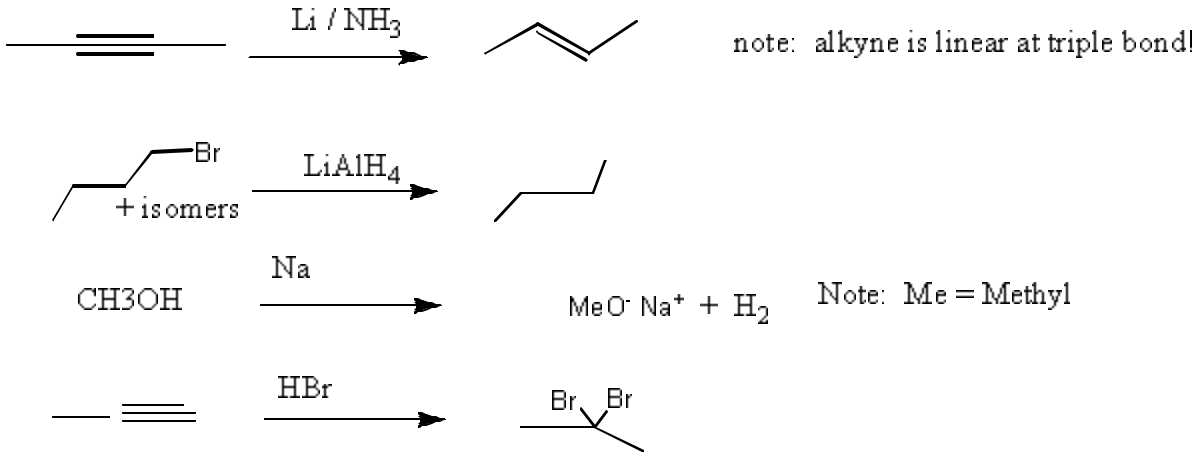
2b. (2) Name **two** kinds of intermolecular interactions that affect physical properties of alkyl halides

Van Der Waals interactions and dipole – dipole interactions

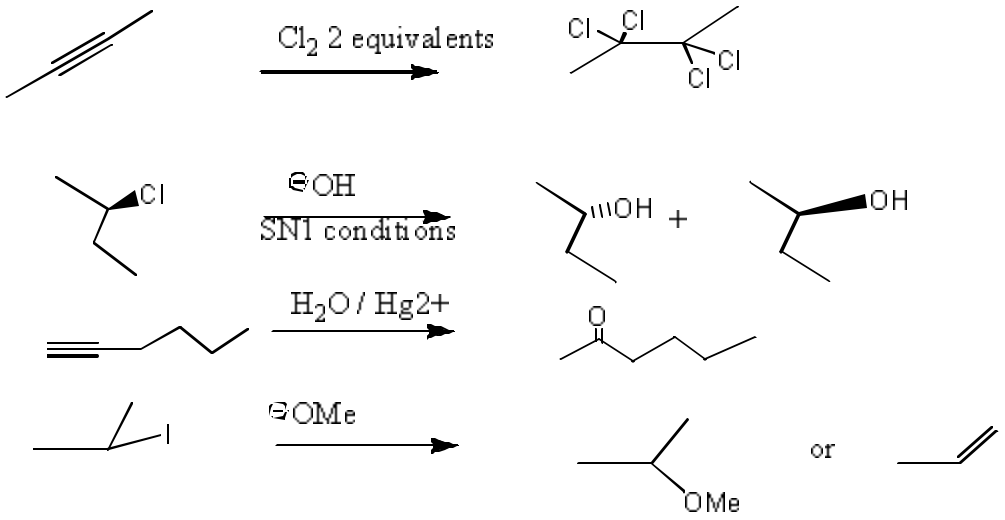
3a. (8) Show the **reagents** required to execute the reactions shown below.



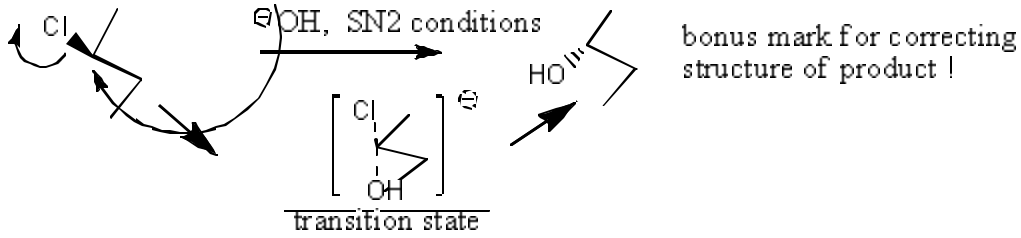
3b. (8) Show the **starting material** required to give the product(s) shown below.



3c. (8) Show the expected **product**(s) *if any*, for each of the reactions shown below.



4a. (4) MECHANISM. Draw a mechanism for the following reaction, showing all intermediates or transition states (*1 mark*), all curly arrows describing electron movement (*2marks*) and all charges (*1 mark*) (if applicable).



4b.(6) Use 3 appropriate chemical equations to show why water (H_2O, pKa 15.7) is capable of quantitatively **protonating** terminal acetylide anion (R C=CH pKa 25).

R-C=CH + H_2O <------> R-C=C- + H3O+ $Ka_1 = 10^{-25}$ Eqn 1

HOH + H_2O <------> HO- + H3O+ $Ka_2 = 10^{-15.7}$ Eqn 2

Add eqn 2 and reverse of eqn 1 : water and hydronium ion cancel to give an equation that describes the protonation of terminal alkyne carbanion using water.

R-C=C- + HOH <------> R-C=CH + -OH {$K = 1/Ka_1 \times Ka_2 = 10^{25} \times 10^{-15.7} = 10^{+9.3}$ }

$10^{+9.3}$ is a very large number : this says that this equation has a very favourable equilibrium constant (K>>1) and so protonation of terminal alkyne carbanions (acetylides) with water certainly will be quantitative and spontaneous.

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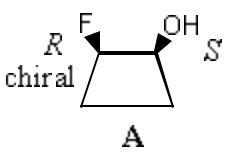
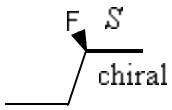
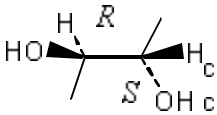
5. (5) **Stereochemistry**. Indicate which of the molecules shown below is chiral (3 marks). Assign the absolute configuration to any chiral centre (1). Draw a diastereomer of **Compound A** (1 mark)

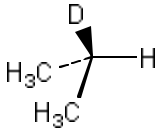


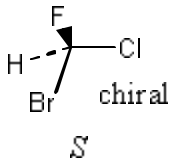
A

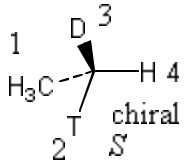




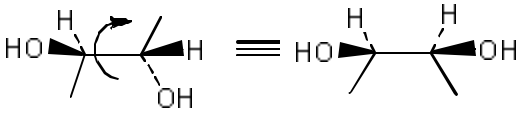
careful - this is an achiral meso compound; conformation can be adjusted to see mirror pla note conformation of molecule does not chang fundamental stereochemical properties since rotation around bonds is typically very rapid;

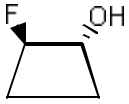






T= tritium
D = deuterium





a diastereomer of **A**
diastereomers are stereoisomers that are not mirror images