CHEMISTRY 341

Final Exam
December 13, 1999

NAME_____

Problem 1	15 pts	_____
Problem 2	12 pts	_____
Problem 3	18 pts	_____
Problem 4	15 pts	_____
Problem 5	32 pts	_____
Problem 6	32 pts	_____
Problem 7	10 pts	_____
Problem 8	10 pts	_____
Problem 9	16 pts	_____
Problem 10	15 pts	_____
Problem 11	12 pts	_____
Problem 12	12 pts	_____
Given	1 pts	**1**
TOTAL	200 pts	_____

TOP 10 reasons Scott wanted to be the organic SI Guy . . .

10. To learn more Organic Chemistry
9. To make fun of Fergie
8. To find out how to synthesize Viagra
7. It's too cold to golf
6. So someone would actually listen to him talk
5. He is a sadist
4. Where else could he find friends?
3. Organic is where it's all happenin'
2. He's a chemistry geek

and the number 1 reason Scott wanted to be the organic SI Guy . . .

1. To pick up women

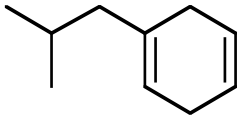
Words of Wisdom from the SI Guy . . .

#1) There are 3 ways to get something done - 1. Do it yourself. 2. Pay someone to do it. 3. Forbid your children to do it.
#2) There are 3 types of people in this world - 1. Those that can count. 2. Those that can't.
#3) English is totally overdid.

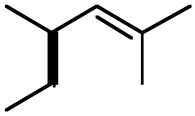
If you need scrap paper or more room, use the back of the test pages.

Please read through each problem carefully. Enter your answers in the spaces provided.

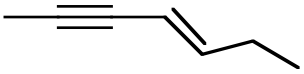
1. Name the following structures (IUPAC) or provide the structure that corresponds to the name for the following. (15 points)

a) 

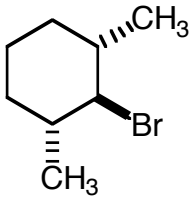
b) (R)-2-chloro-3-ethylpentane

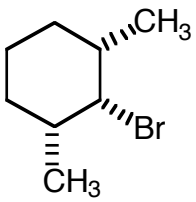
c) 

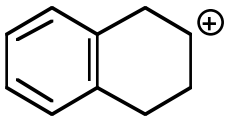
d) a meso form of 2,3-dibromobutane

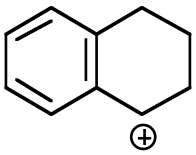
e) 

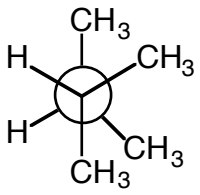
2. Circle the most stable molecule in each pair below. (12 points)

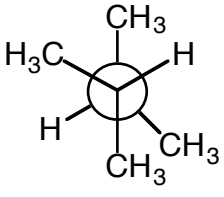


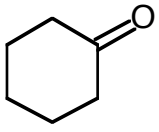


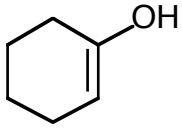




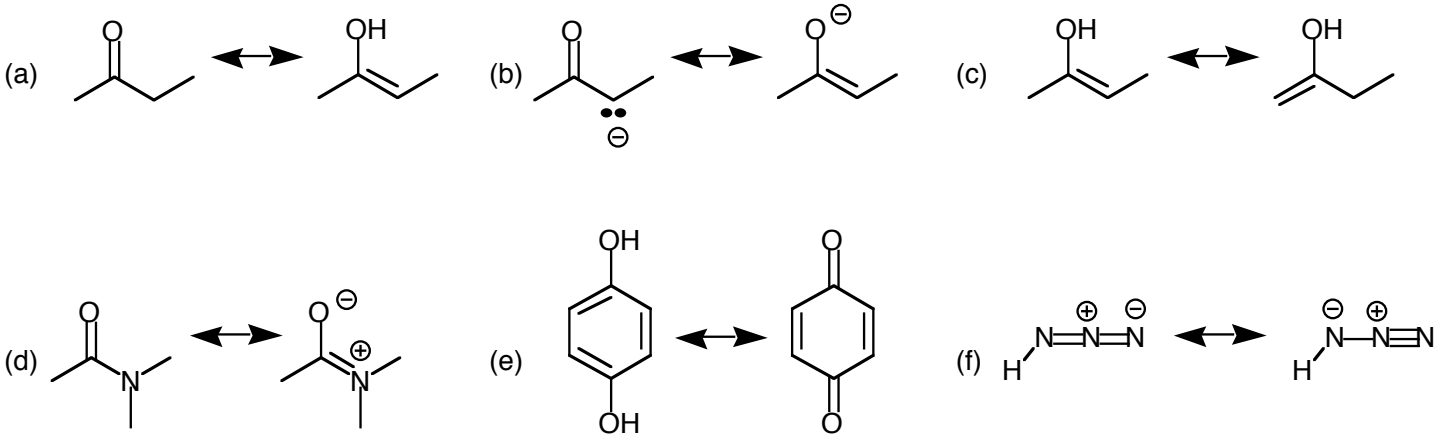




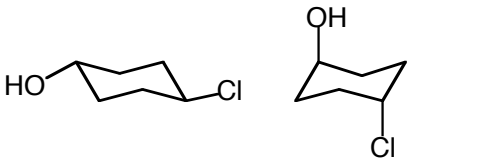


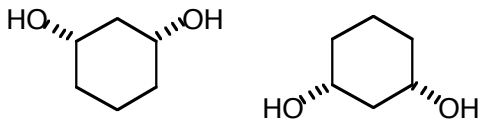


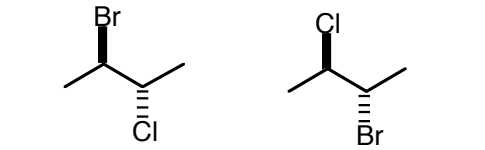
3. Circle all of the following pairs which represents resonance forms. (18 points)

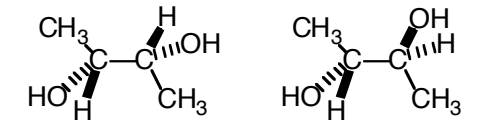


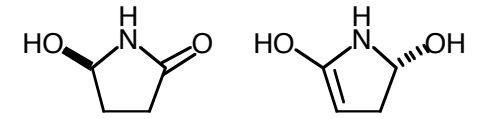
4. What is the relationship between the following pairs of molecules? (15 points)





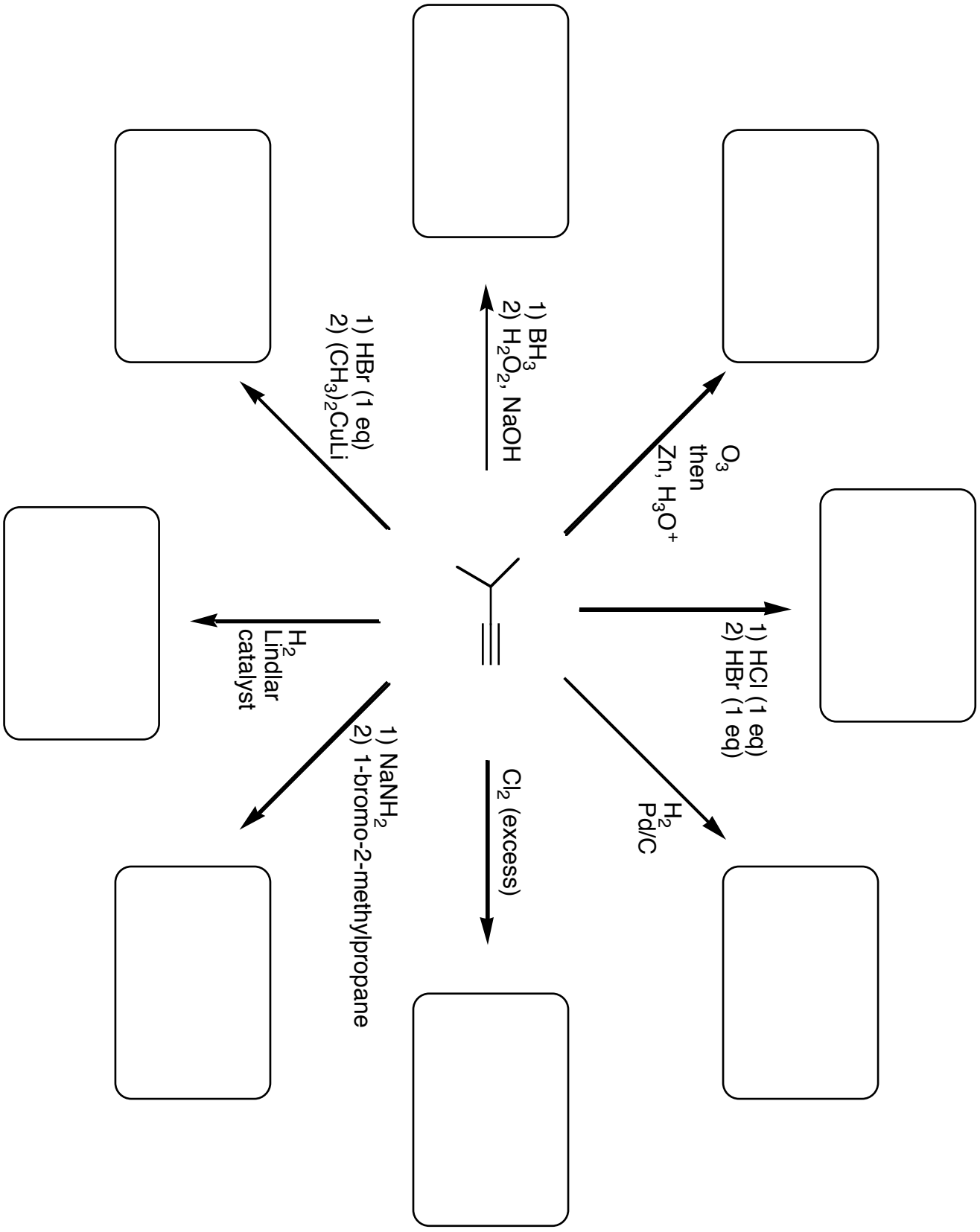




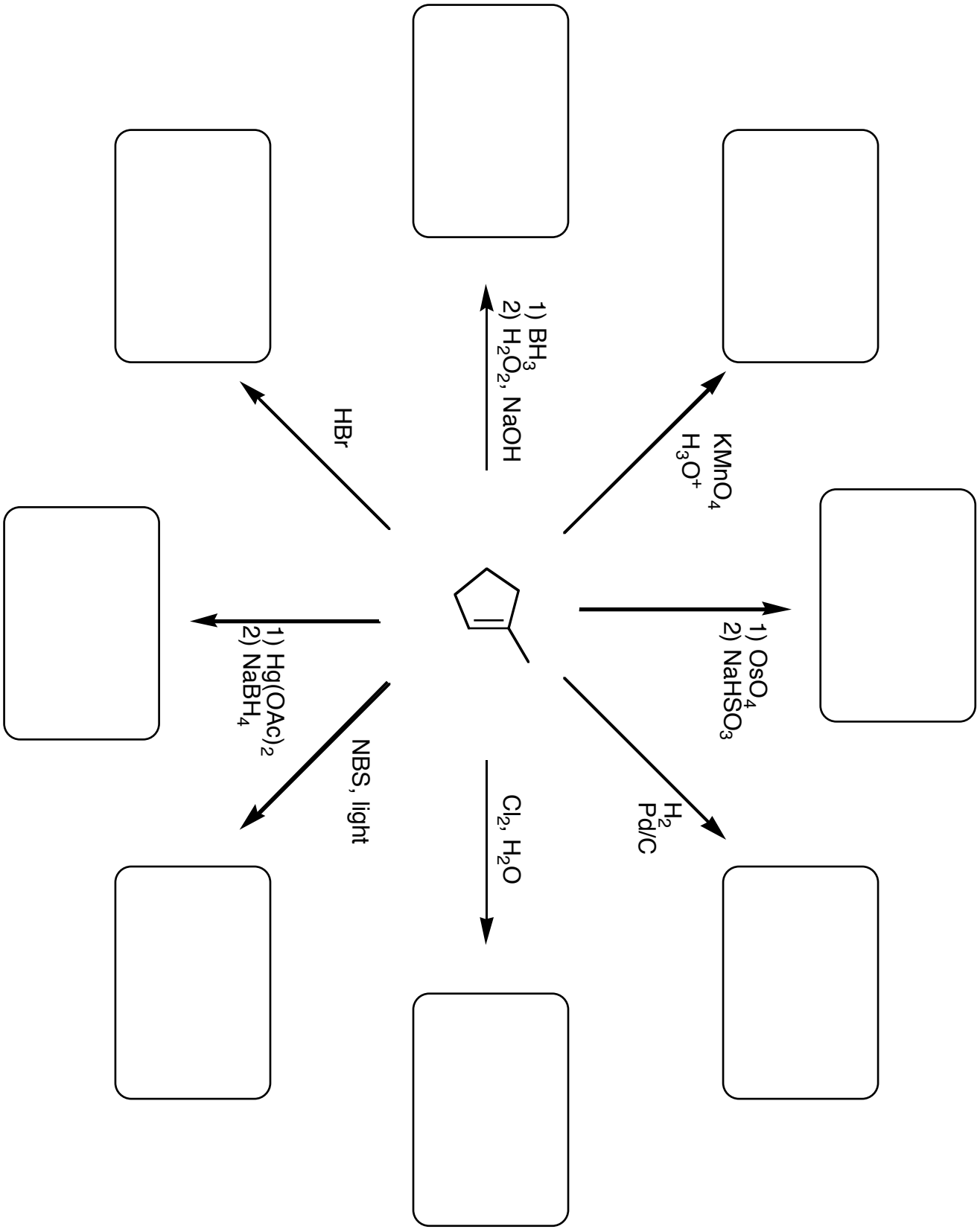


	check one				
	identical	enantiomers	diastereomers	constitutional isomers	conformers
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐

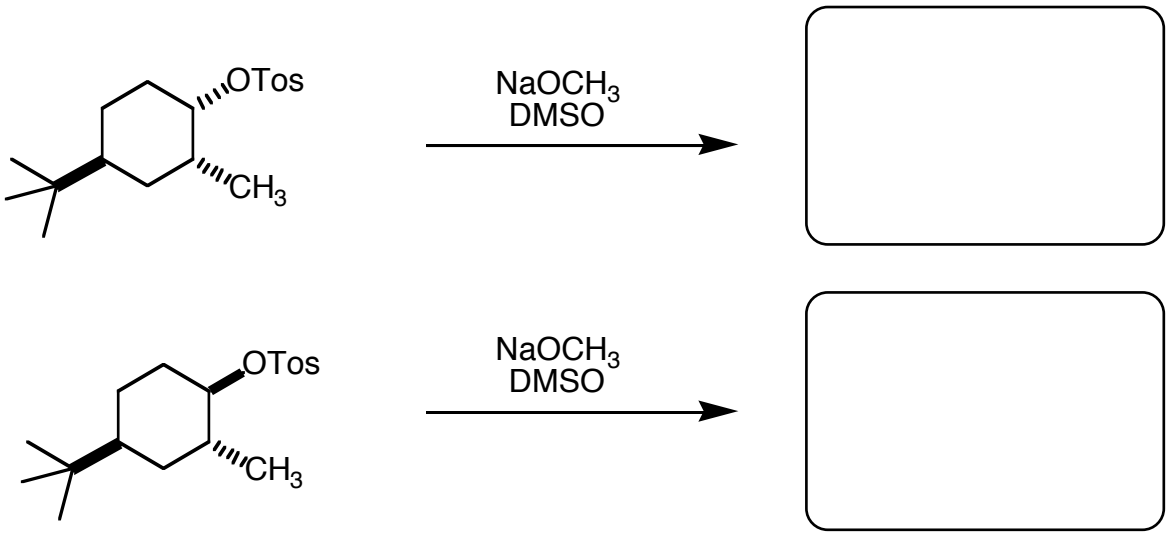
5. Fill in the boxes for the major organic products of the following reactions. Indicate stereochemistry clearly where necessary. (32 points)



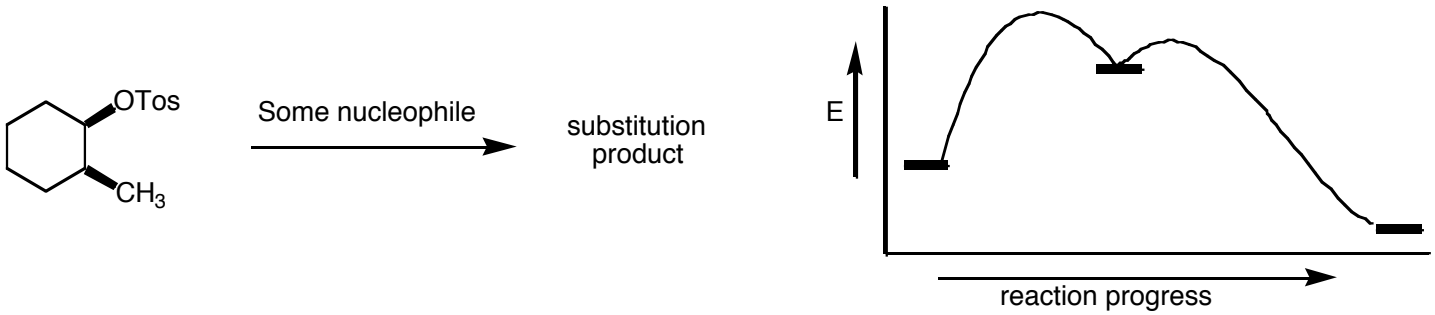
6. Fill in the boxes for the major organic products of the following reactions. Indicate stereochemistry clearly where necessary. (32 points)



7. The two tosylates shown below react differently under identical reaction conditions. One will undergo a facile S_N2 reaction while the other will easily eliminate via an E2 mechanism. Draw the structure of the major product for each reaction. (10 points)



8. The following substitution reaction is described by the accompanying reaction diagram. Show on the diagram with arrows, the activation energy for the rate determining step and ΔG. (10 points)

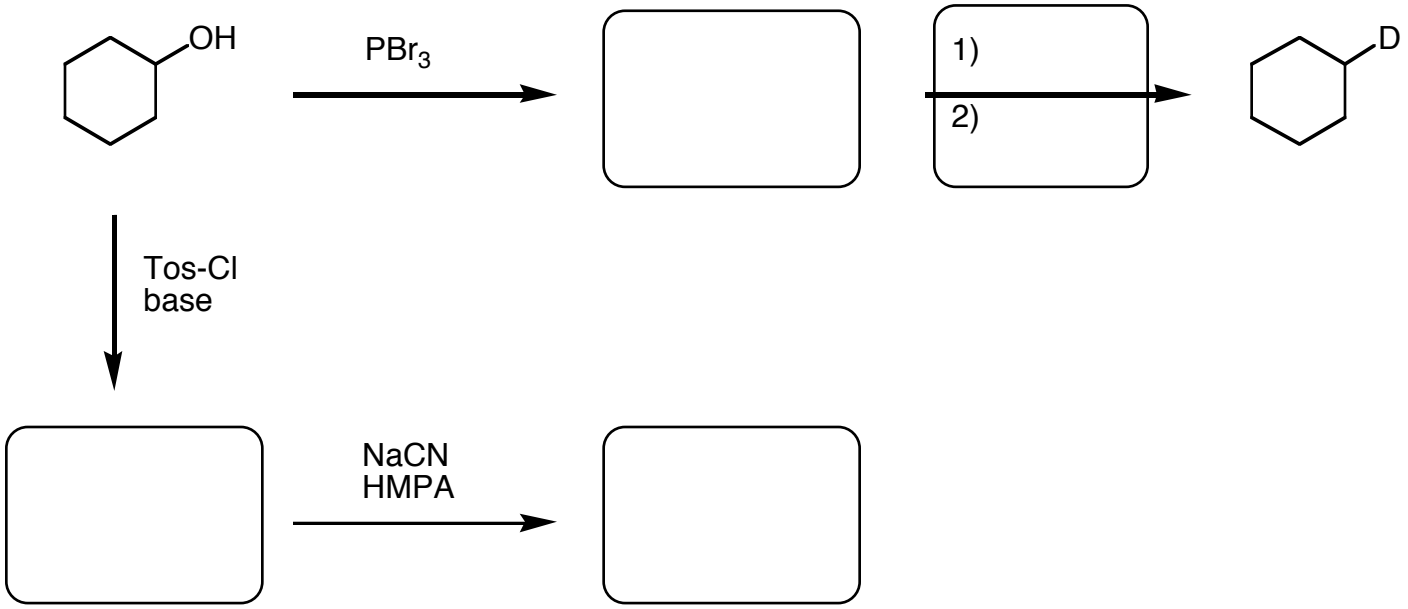


(a) Does the reaction take place by a S_N1 or a S_N2 mechanism?

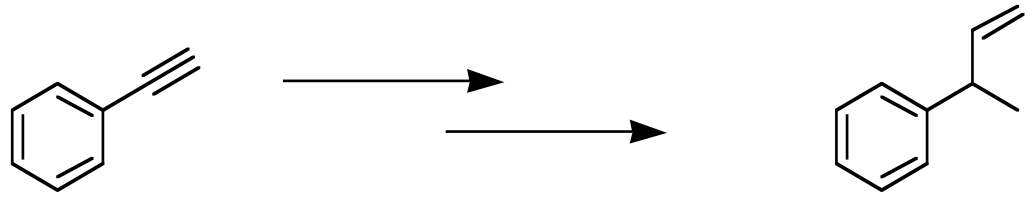
(b) Check the box for the statement that is true about the reaction.

- ☐ A racemic mixture of enantiomers will be produced.
- ☐ A mixture of two diastereomers, both racemic will be produced.
- ☐ A mixture of two diastereomers, both chiral will be produced.
- ☐ A single stereoisomer will be produced.

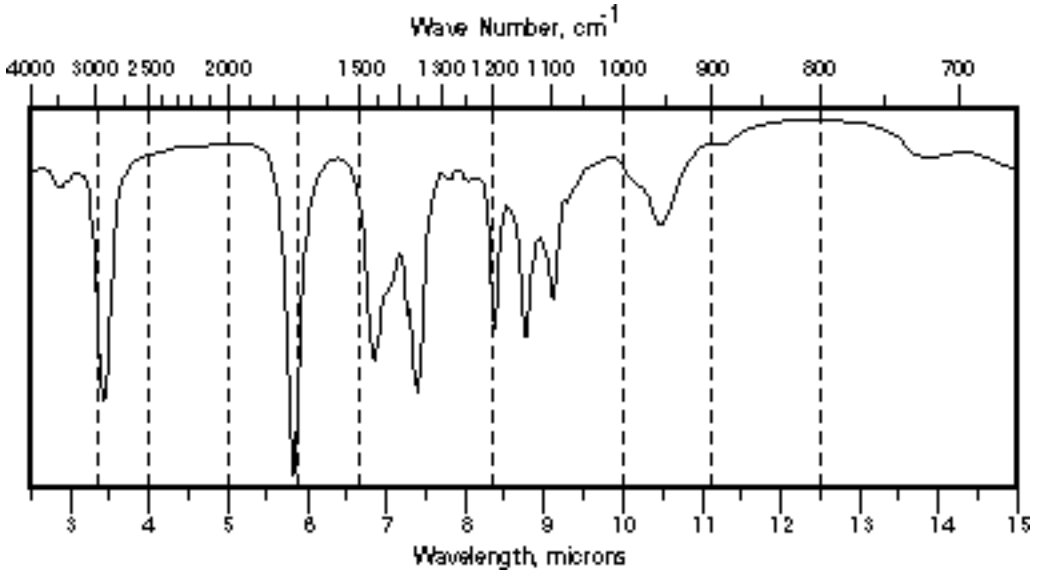
9. Fill in the missing structure or reagents where necessary. (16 points)

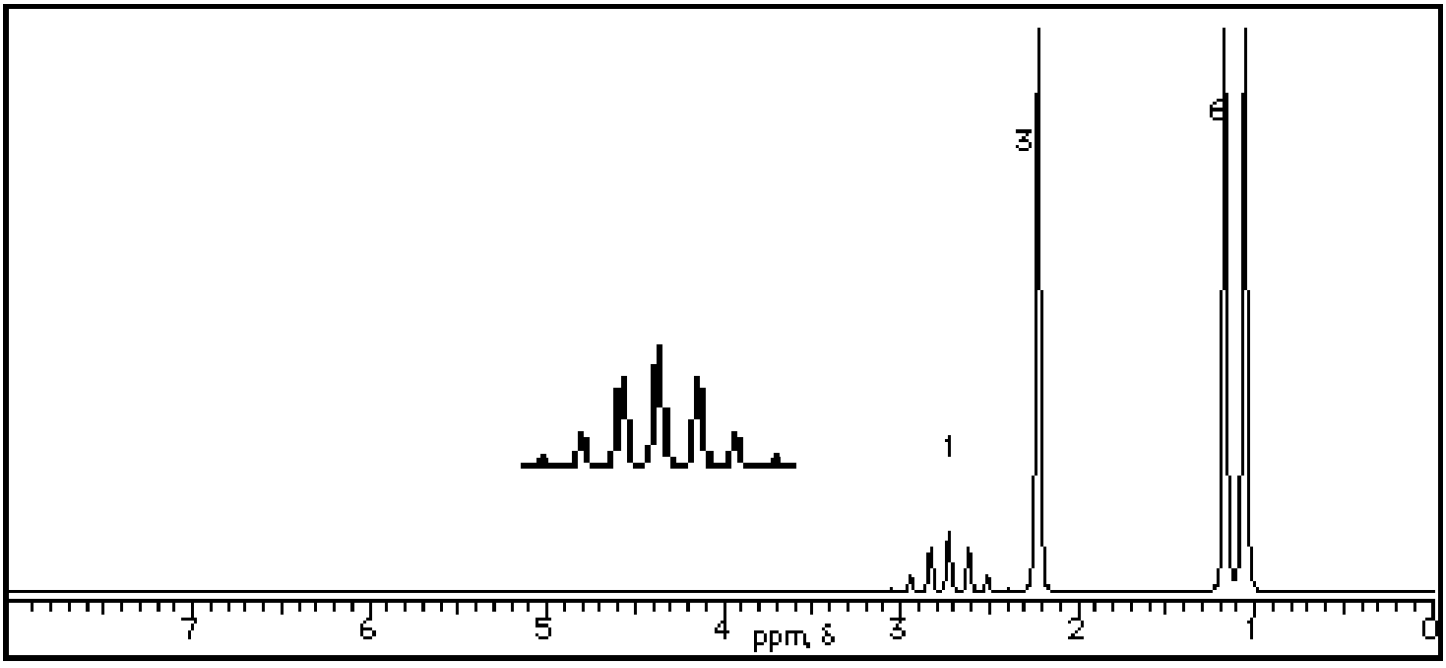


10. Starting from ethynyl benzene, synthesize the molecule shown using any other reagents you need. More than one step will be necessary. Show all reagents and intermediate structures along the way. (15 points)



11. Below is the IR and ^{1}H NMR spectra for an unknown compound with a molecular formula $C_5H_{10}O$. In the ^{13}C NMR, four resonances appear at 210, 45, 22, and 16 ppm.

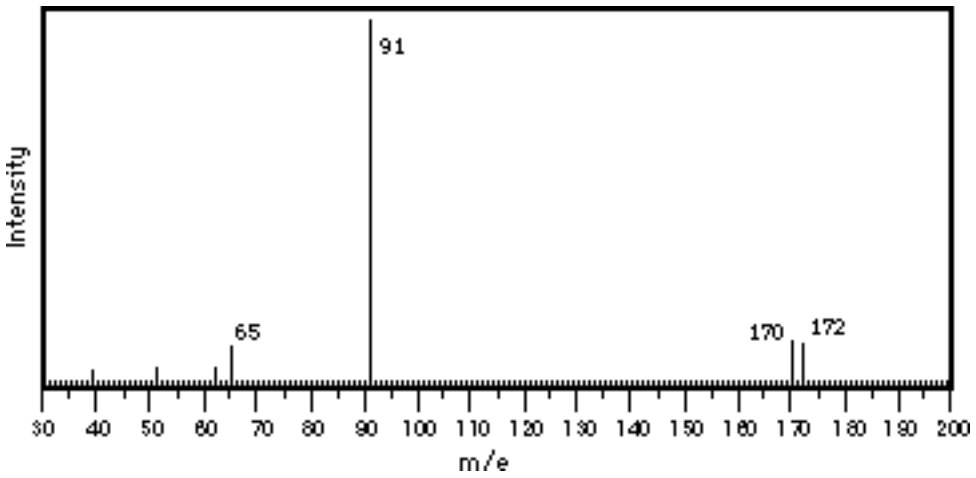




(a) The IR stretching frequency at 1720 cm^{-1} corresponds to what functional group? (4 points)

(b) What is the structure of this molecule? (8 points)

12. A molecule with the molecular formula C_7H_7Br displays the following mass spectrum.



(a) How many units of unsaturation are present? (3 points)

(b) What is the structure of the base peak at m/e 91? (3 points)

(c) What is the structure of the molecule? (3 points)

(d) Briefly explain why there are two peaks at m/e 170 and 172 of nearly equal amounts. (3 pts)

USEFULL DATA

Infrared Correlations:

C-H stretches:	alkanes	2850 - 2960 cm^{-1}	medium/strong
	alkenes	3020 - 3100 cm^{-1}	medium
	alkynes	3300 cm^{-1}	strong (sharp)
O-H stretch:	alcohols	3400 - 3650 cm^{-1}	broad/strong
C=O stretch:	carbonyl	1680 - 1750 cm^{-1}	strong
CC triple bond:	alkyne	2100 2260 cm^{-1}	medium
CN triple bond	nitrile	2210 - 2260 cm^{-1}	medium

^{1}H NMR Correlations:

C-H	(alkanes)	0.5 - 1.5 ppm
allylic	(adjacent to sp^2 carbon)	1.5 - 2.5 ppm
Y-C-H	(Y = O, N, Br, Cl, etc)	2.5 - 4.5 ppm
C=C-H	(alkenes)	4.5 - 6.5 ppm
sp^2 aromatic	(benzene rings)	6.5 - 8.0 ppm
O=C-H	(aldehydes)	9.5 - 10.0 ppm
CO_2H	(acids)	11.0 - 12.0 ppm

^{13}C NMR Correlations:

C	(alkanes)	10 - 60 ppm
Y-C	(Y = O, N, Br, Cl, etc)	40 - 80 ppm
C=C	(alkenes)	100 - 150 ppm
sp^2 aromatic	(benzene rings)	120 - 160 ppm
O=C-O	(esters)	175 - 200 ppm
$O=CR_2$	(aldehydes, ketones)	200 - 220 ppm

Atomic Weights

C	12
H	1
O	16
Cl	35 (75%), 37 (25%)
Br	79 (52%), 81 (48%)