First Hour Exam

Name:_____

Recitation instructor's name:_____

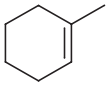
Recitation day and time:_____

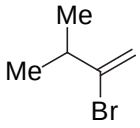
Page	Possible points	Score
2	15	
3	24	
4	23	
5	21	
6	17	
TOTAL	100	

You have 2 hours to complete the exam.

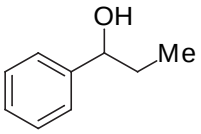
If you are caught cheating, you will receive at best an F on this exam!

1) Provide the products of the following reactions. If no reaction would occur, then write NR. Draw all possible stereoisomers (i.e., draw dashed and bold lines as needed) and indicate if they would be produced in equal or unequal amounts. There is an appropriate aqueous work up for each reaction **UNLESS OTHERWISE NOTED** (3 points each answer except where indicated).

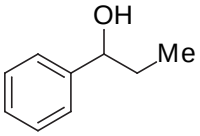
A)  $CHBr_3$ / KO-C(Me)$_3$ →

B) 

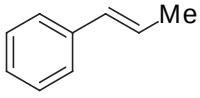
Li (2 equivs)
→
then, D_2O work-up

C) 

Jones reagent →

D) 

PCC →

E) 

OsO_4 ($_1$%) / H_2O /
→
$K_3Fe(CN)_6$ (1 equiv)

2) Provide the most efficient syntheses of the molecules shown below using organic reagents of 4 carbons or less and any common organic or inorganic reagents you wish. **If your synthesis requires more than one step, you must write the product of each step.** You do not have to include aqueous work up conditions.

A) 

6 pts

B) 

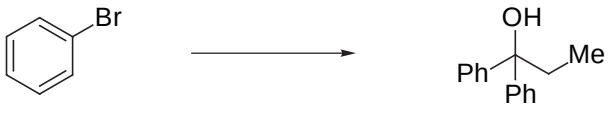
Do this using a different method than A, 12 pts.

C) 

6 pts

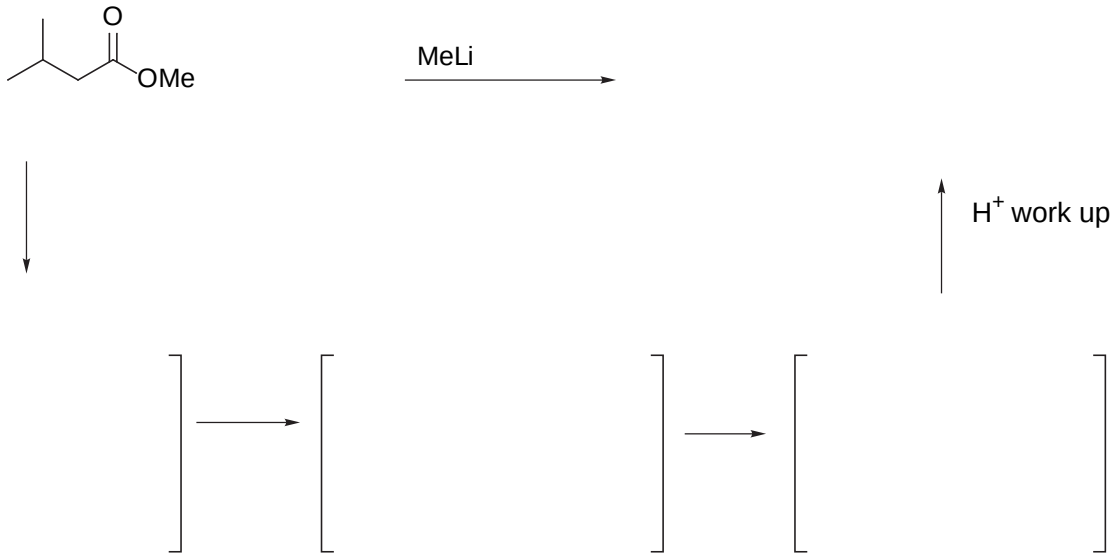
D) 

6 pts

E) 

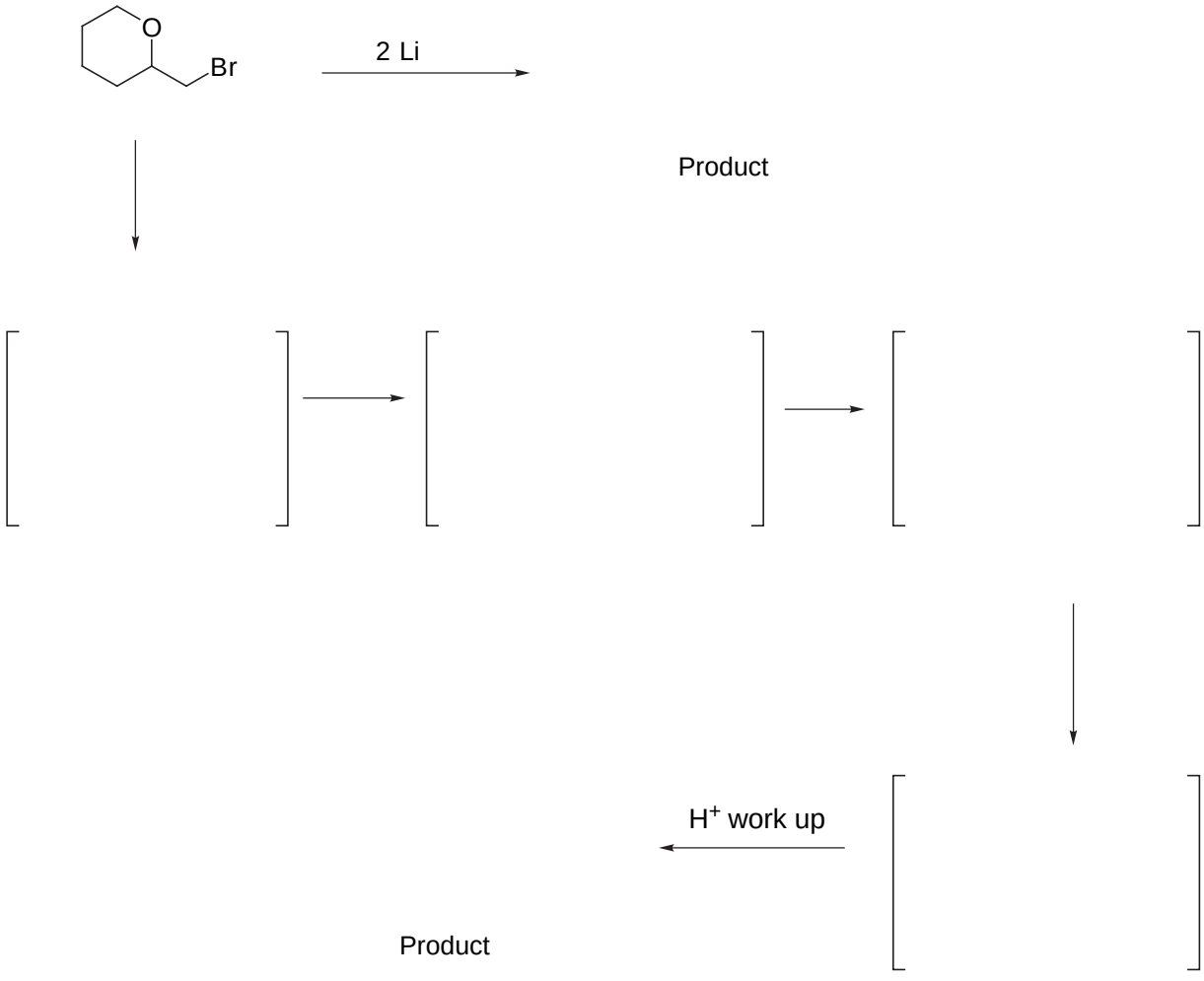
Do this in no more than two steps, 6 pts!

3) Provide the products and mechanisms for the reactions shown below . I have provided you with space to draw the intermediates, be sure to show all arrows, charges, etc., including the work up (continued on next page)!

a) 

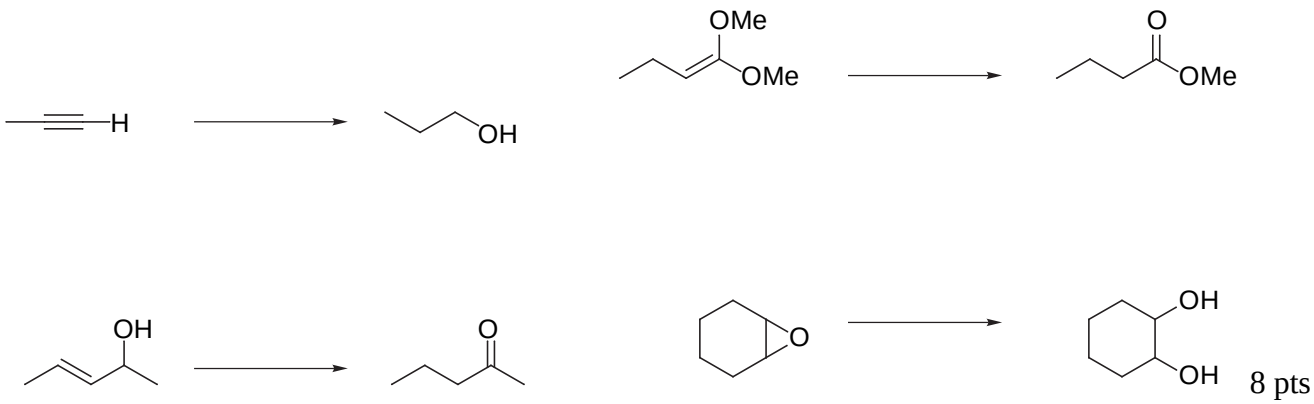
11 pts

b)



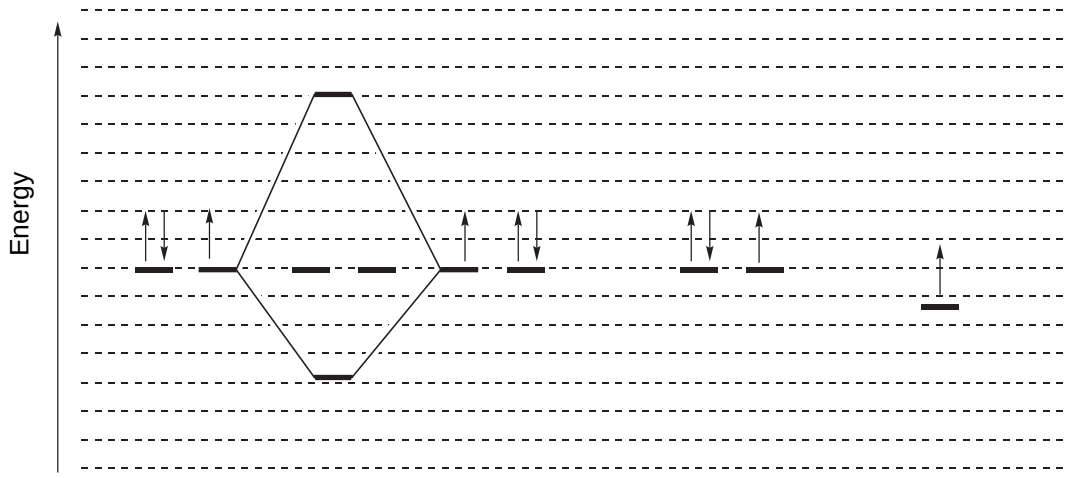
13 pts

4) Label each of the following reactions as **oxidation, reduction, neither, can't tell**.



8 pts

5) The molecular orbital diagram for a hypothetical molecule, :A-A:, is shown below. Note that there is a lone pair on atom A, and that A-A form a single bond using SP^3 hybrid atomic orbitals.
A) Fill the molecular orbitals in :A-A: with electrons as appropriate, and label each molecular orbital as either **S, P, SP^3, SP^2, SP, n, σ, σ*, π, or π*** as appropriate (note that there are four molecular orbitals that you have to label and that you do not need to label the atomic orbitals).
B) Complete the molecular orbital diagram for the hypothetical molecule, :A-B shown below to the right of :A-A:, and fill the molecular orbitals with electrons as appropriate. Note that atom B does not contain a lone pair. For each molecular orbital you draw, indicate if it is **higher energy, lower energy, the same energy or if you cannot determine**, as the corresponding molecular orbital in molecule :A-A: (hint, we've seen example of all four possibilities).
C) Molecule :A-B is an electrophile. Circle the molecular orbital that gets attacked when :A-B acts as an electrophile.
D) Is :A-B a **better, worse, same, or can't tell,** electrophile than :A-A: (circle one answer).
E) Molecule :A-B is also a nucleophile. Circle the molecular orbital that does the attacking when :A-B acts as a nucleophile.
F) Based on the energy of the orbital you circled in Is :A-B a **better, worse, same, can't tell,** nucleophile than :A-A: (circle one answer).



11 pts total

6) In class, I suggested that you make schemes similar to the one shown below with a product in the middle of a circle, and arrows pointing to the product with starting materials and reagents for how to synthesize that product. Complete the scheme below by providing three different classes of starting materials and the necessary reagents to synthesize the molecule show in the center of the circle. By different classes of starting materials, I mean that the functional group must be different in each of your starting materials. You may use reactions learned this semester or last semester. 6 pts