Version A

CHM 2120
MIDTERM
Oct15, 2012

Name:_____KEY_____ **Seat:_____**

Student number:_____

Approximate total number of marks: 55

Notes:

- For questions in which mechanisms are not required, part marks might be given for incorrect answers with plausible mechanisms.
- Re-marks requests might not be granted for midterms written in pencil (all questions will be re-graded if a re-mark is requested).

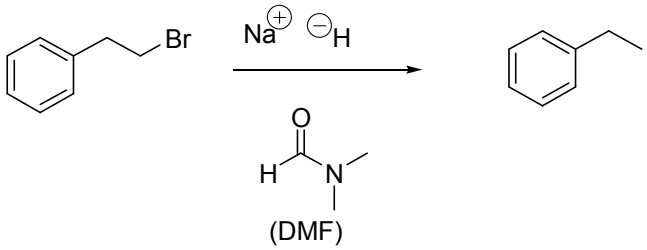
1a	2a	3b	4b	5b	6b	7b	8			1b	2b	3a	4a	5a	6a	7a	0
1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89 Ac	104 Rf	105 Ha	106 106												

pK_a table

Acid	pK_a
HCl	-8
ROH_2^+	-2
H_3O^+	-1.75
RCOOH	5
R_3NH^+	10-11
H_2O	15.75
ROH	16-18
H_2	36
RNH_2	35-40
RCH_3	55

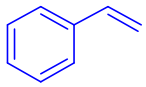
1.

a. Explain why the following reaction will not work as shown. **(4 points)**
b. Give the true product of the reaction sequence. **(2 point)**
c. How would you make the alkane shown from the alkylbromide shown? **(4 points)**

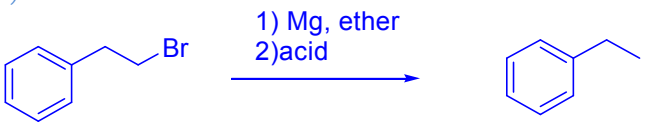


a) 1. H- is a strong base but a poor ncuophile
2. bromide is a good leaving group
3. With no nucleophile SN chemistry can't occur

b)



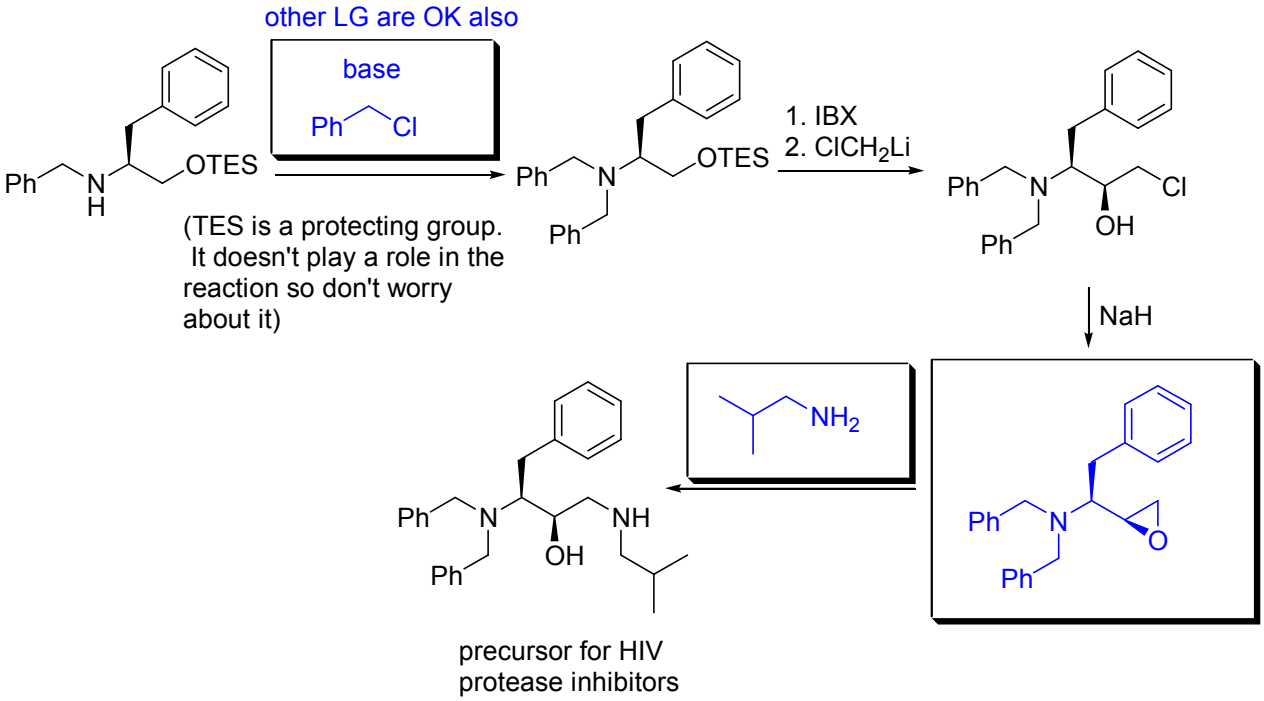
c)



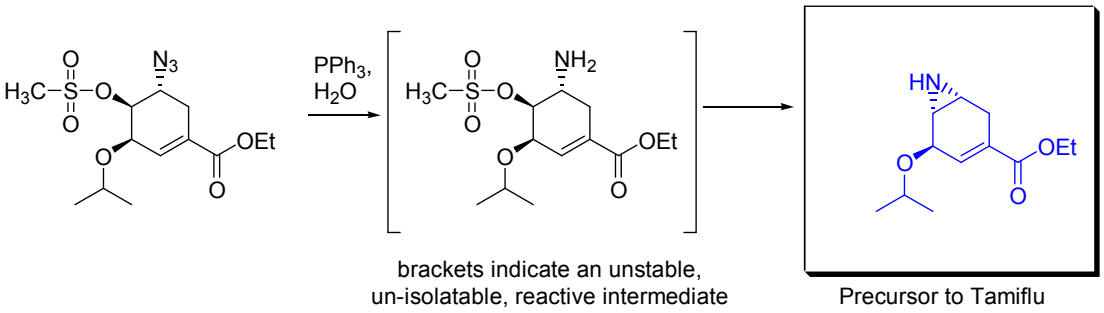
1)base for E2, 2)H2 for hydrogenation also OK.

2. Provide the products or reagents for the following reactions.

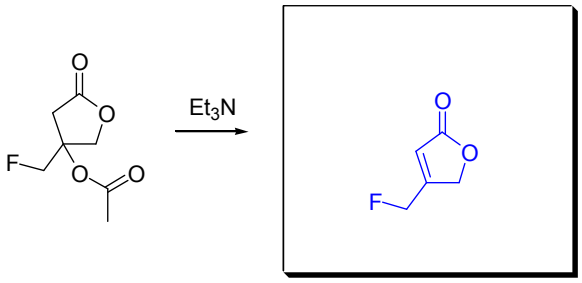
(6 points)



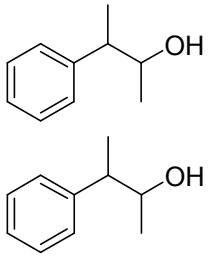
(2 points)

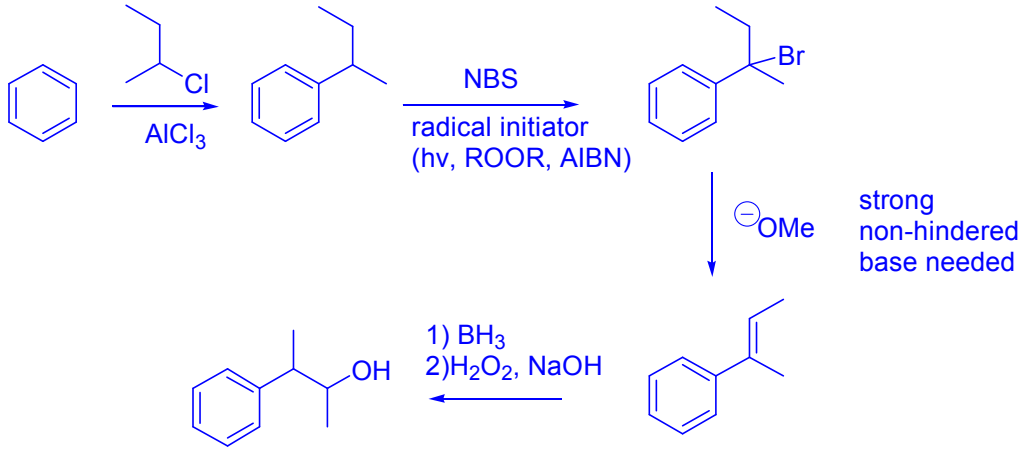


(2 points)



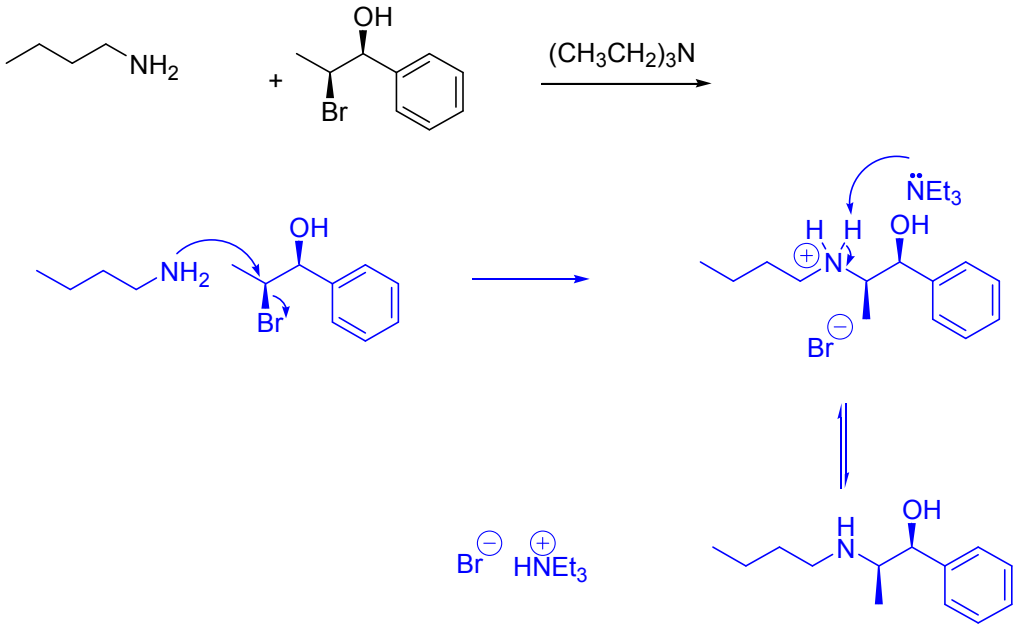
3. Provide a regiochemically controled synthesis of this molecule from benzene (**10 points**).



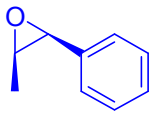


4.

a. Give the full detailed mechanism for the formation of the major product in the reaction below. **(5 pts)**



b. Show the product if NaH were used as the base, instead of $(CH_3CH_2)_3N$. **(2 points)**



5. Use molecular orbitals to show why the proton and leaving group must be antiperiplanar in an E2 reaction. Show a reaction conrdinate diagram for the E2 reaction. Clearly indicate starting materials, products, and transition state are and their relative energies. Identify the energy differences that coorespond to the activation energy and overall change in energy. (**8 points**).

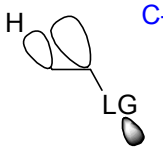
E2

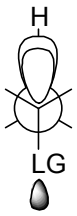
C-H σ donates to C-LG σ*

orbital only overlap when proton and leaving group are antiperiplanar

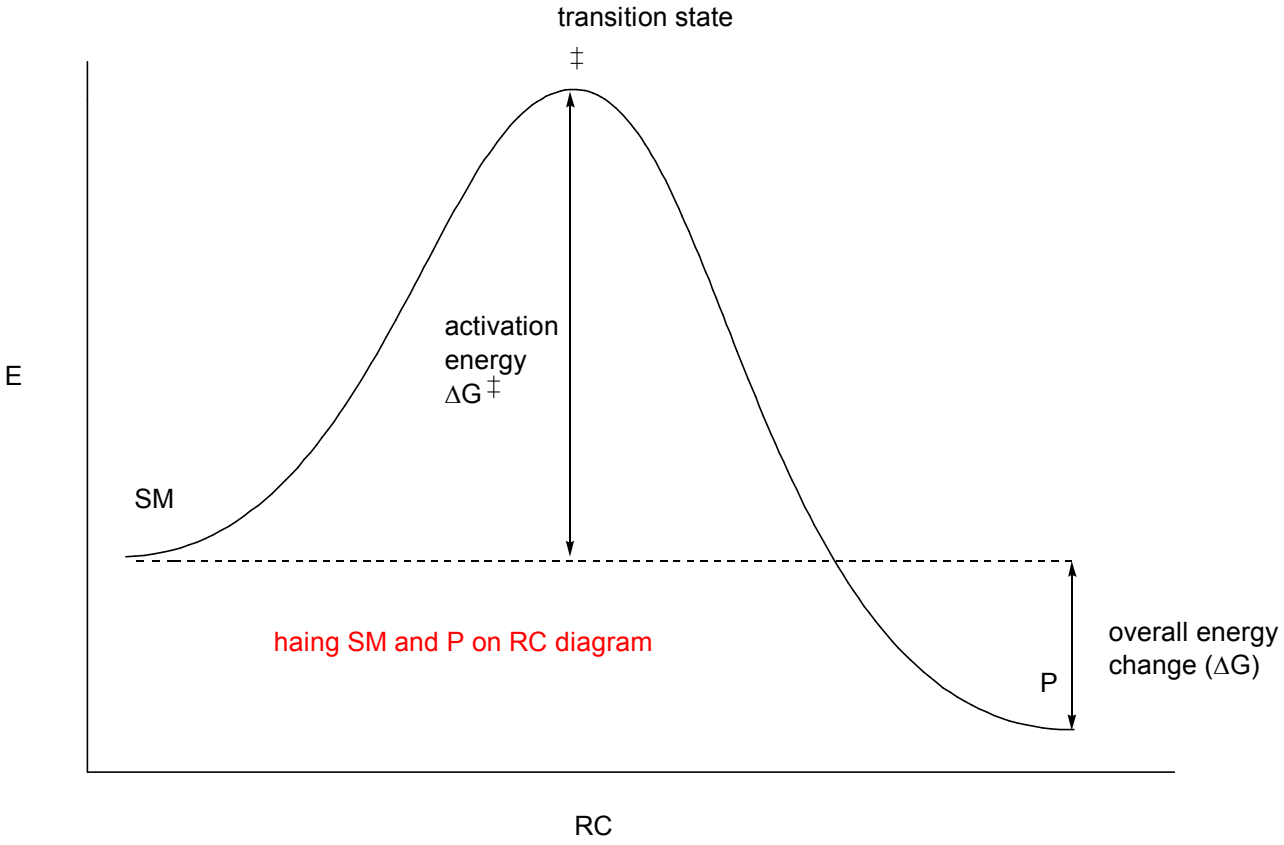
atomic orbital (p or sp hybrids = 1/2 marks)

C-H σ filled orbital

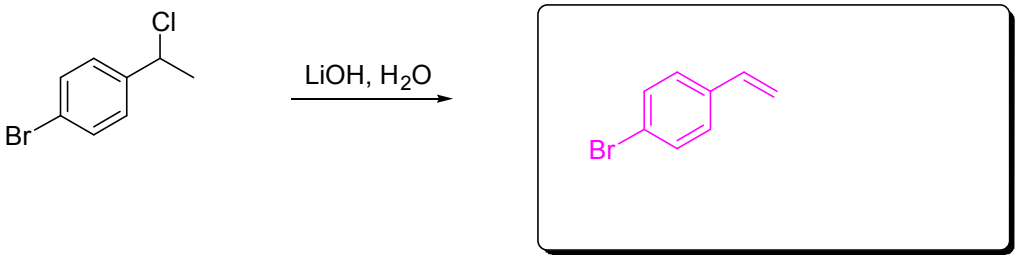


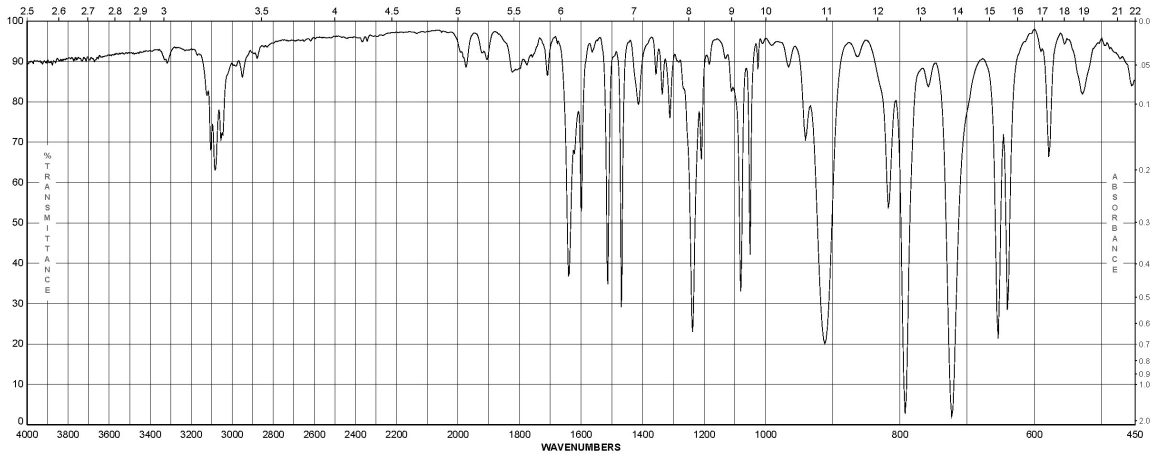


C-LG σ* empty orbital

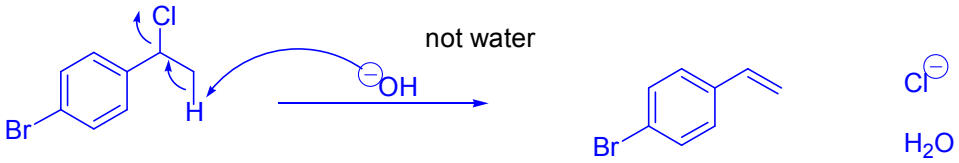


6. The product of this reaction has the IR shown below. Provide a detailed reaction mechanism. Identify if the reaction was S_N1, S_N2, E1 or E2. Show the product. (**10 points**)





E2



BONUS: **(3 points)**

Provide a detailed mechanism for the following transformation: