

CHM 2120A  
 Midterm #1  
 October 1, 2014

# ANSWERS

First Name: \_\_\_\_\_ Last Name: \_\_\_\_\_

Student Number: \_\_\_\_\_ Seat number: \_\_\_\_\_

Approximate total number of marks: ~~2~~ 73

The marks are given as a guide and are subject to change.

You can write in pen or in pencil.

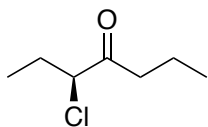
The use of molecular models is permitted but they cannot be shared.

The use of calculators or other electronic devices is not permitted.

There is a  $pK_a$  table on the last page.

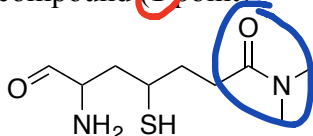
1a	2a	3b	4b	5b	6b	7b	8	1b	2b	3a	4a	5a	6a	7a	0		
1 H															2 He		
3 Li	4 Be										5 B	6 C	7 N	8 O	9 F	10 Ne	
11 Na	12 Mg										13 Al	14 Si	15 P	16 S	17 Cl	18 Ar	
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 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												

1. Name the following molecule. (3 points)

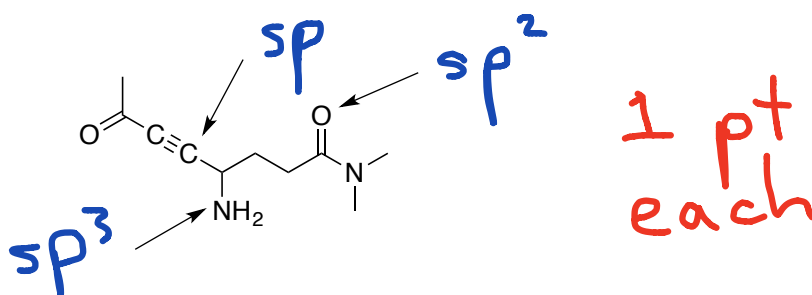


(S)-3-chloroheptan-4-one  
 (1) (1) (1)

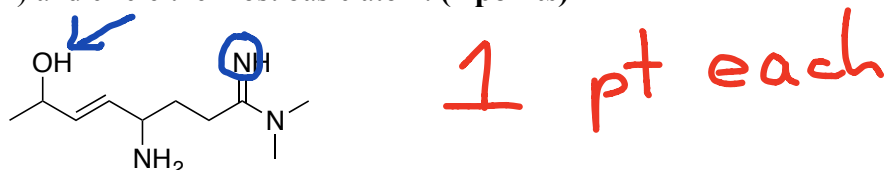
2. Circle an amide in the following compound (1 point)



3. What is the hybridization of each of the indicated atoms? (3 points)

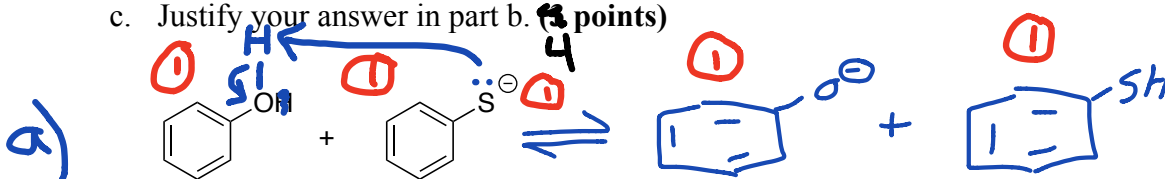


4. Point to the most acidic proton ( $\rightarrow$ ) and circle the most basic atom. (2 points)



5. For the following reaction:

- Draw the mechanism and products. (5 points)
- Determine the direction of the equilibrium. (1 point)
- Justify your answer in part b. (3 points)



c) - compare bases (-SPh versus -OPh)

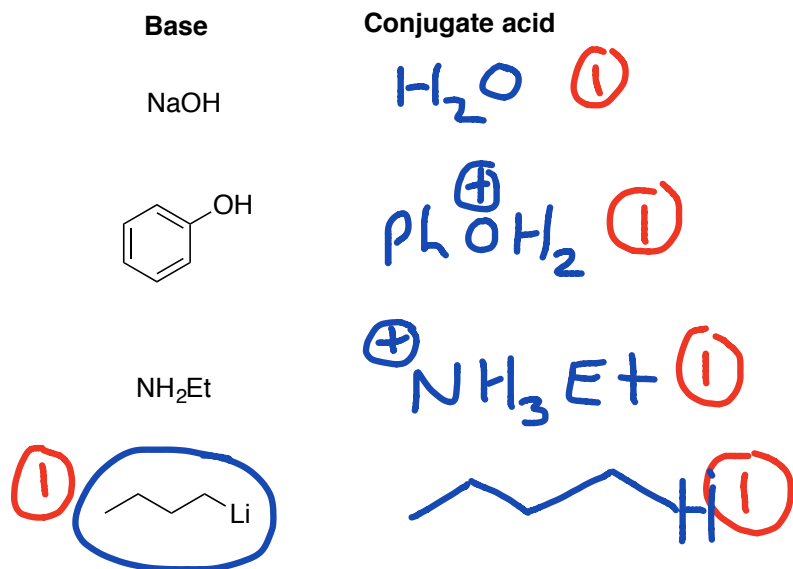
(1) S is larger than O, so it can spread out (disperse) its electrons over a larger volume, making it more stable. (1)

- A more stable base is a weaker one

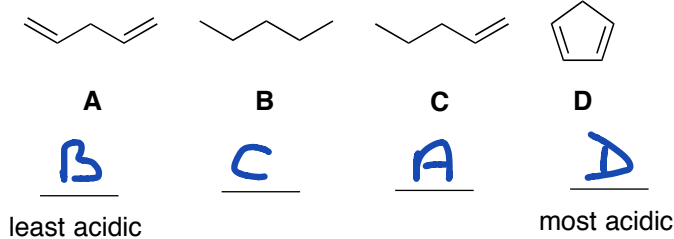
- The equilibrium lies to the side of the weaker base

6.

- a. Draw the conjugate acid of each of the bases shown below. (4 points)  
 b. Circle the base that would deprotonate 1-butyne with an equilibrium that favours the products. (1 point)



7. Rank the following compounds in increasing order of acidity. (3 points)



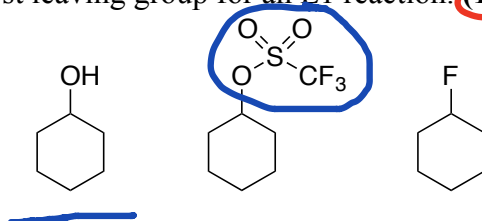
-1 per error

8. Draw the predominant form of the following compound at pH 6 (1 point)

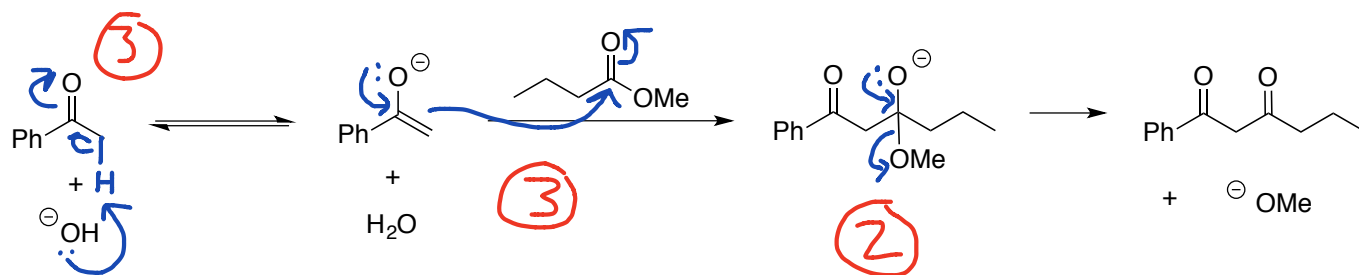


9. For the following compounds:

- a. Circle the best leaving group for an E1 reaction (1 point)  
 b. Underline the worst leaving group for an E1 reaction. (1 point)

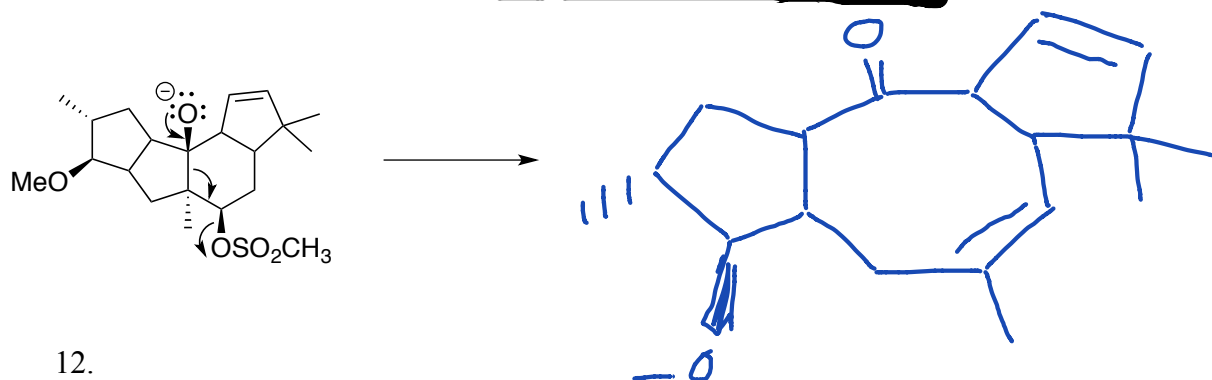


10. Add curved arrows to describe the mechanism for the following reaction. All reagents and intermediates have already been shown. (8 points)



11.

a. Draw the product of the reaction step shown below. (2 points)

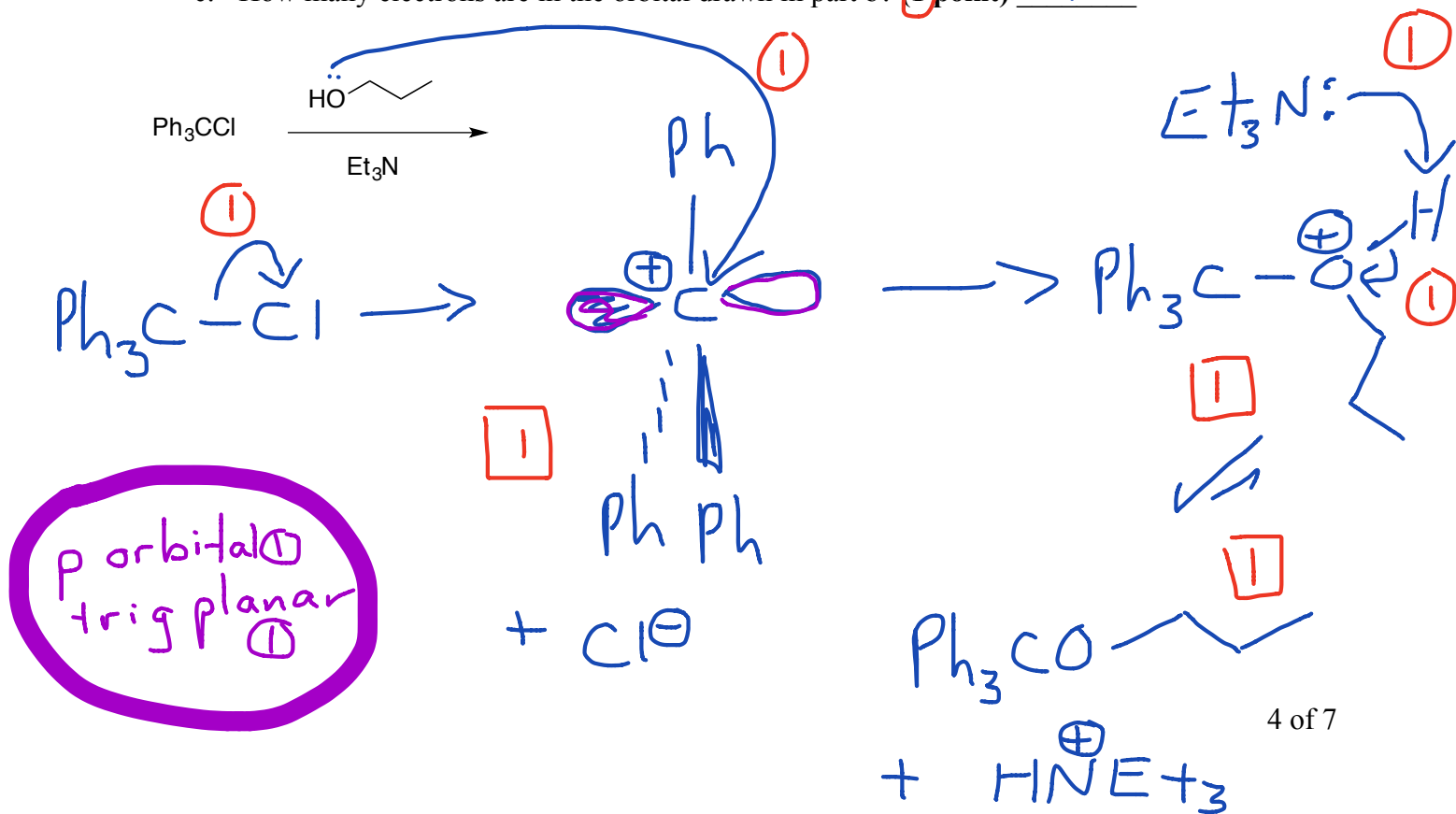


12.

a. Draw the mechanism and substitution products for this reaction. (7 points)

b. Draw the reactive orbital on the carbocation intermediate. (2 points)

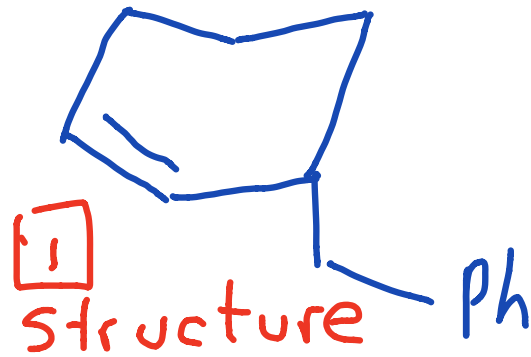
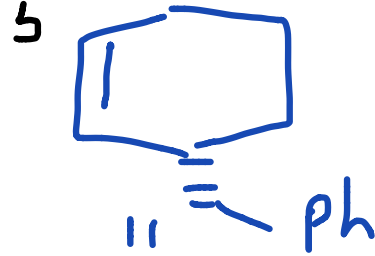
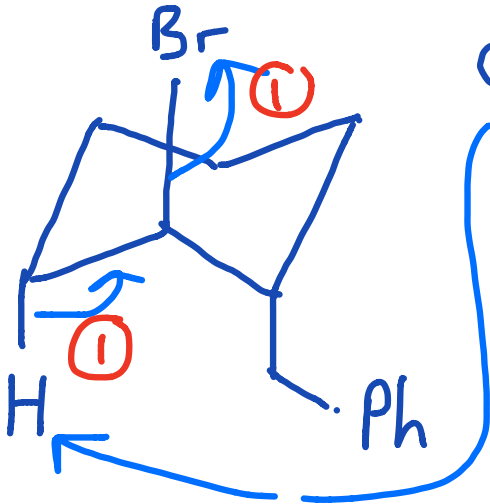
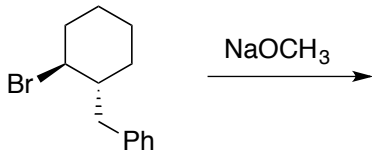
c. How many electrons are in the orbital drawn in part b? (1 point)



13.

① chair well-drawn  
 ① correct molecule  
 ① H+ Br anti-periplanar  
 ① E2

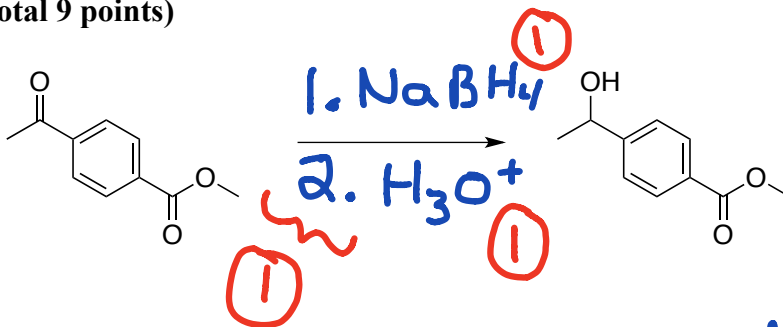
- a. What is the major mechanism for the reaction below? (1 point)  
 b. Draw the starting material in its reactive conformation (3 points)  
 c. Draw the mechanism and the major organic product. (3 points)



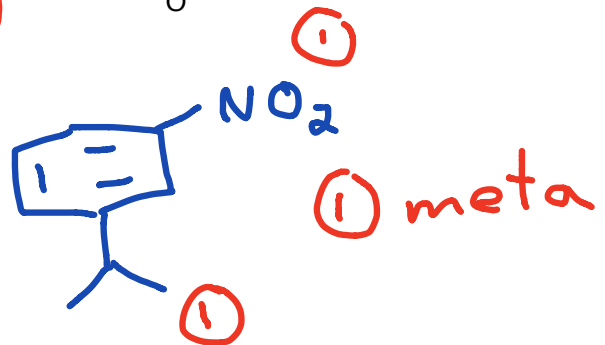
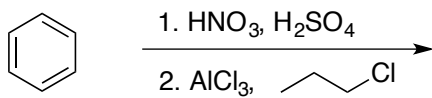
① correct regiochem

14. Draw the missing reagent(s) OR the major organic product for the following reactions. (3 points each; total 9 points)

a.

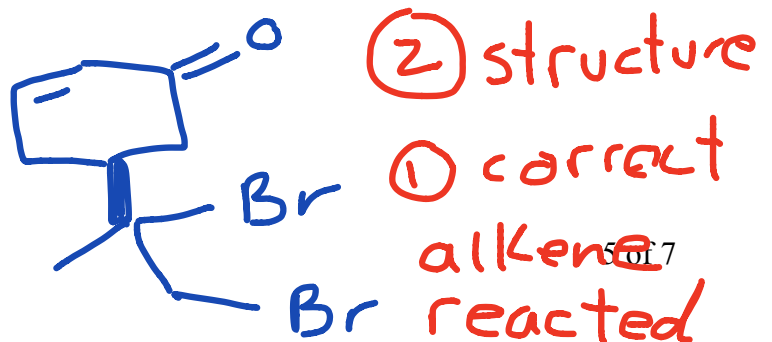
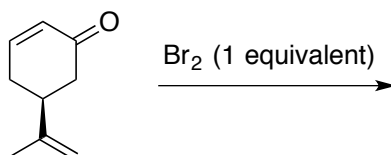


b.



① meta

c.

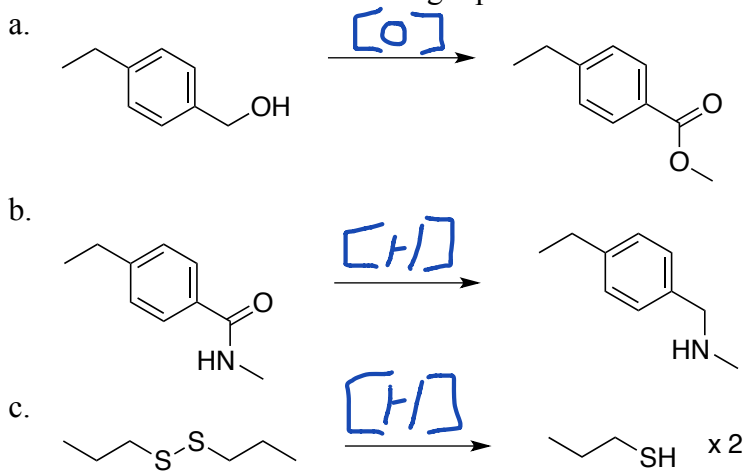


② structure

① correct alkene reacted

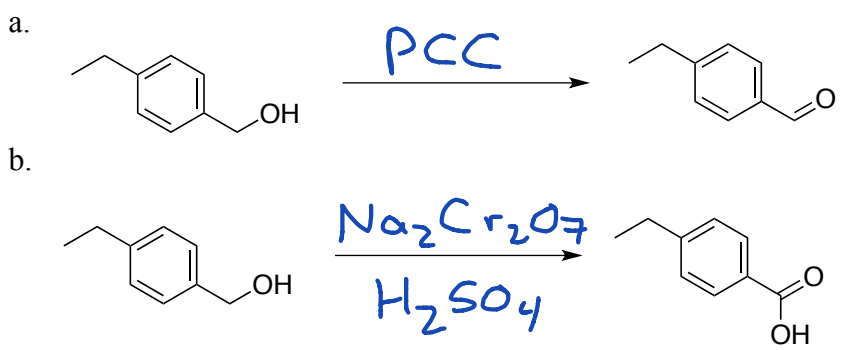
[O] [H]

15. Decide whether each of the following represents an oxidation or a reduction reaction. (3 points)



1 pt each

16. Add the appropriate reagents to effect the following transformations: (2 points)



BONUS! (2 points)

Associate each molecule with its role/effect:

CS ———— Sunscreen

CCC(=O)O ———— Foot odour

COc1ccc(/C=C/C(=O)c2ccc(C(C)(C)C)cc2)cc1 ———— Halitosis (bad breath)

-1 per error