Chemistry 220b-01
Exam 2 (100 pts)
Tuesday, March 1, 2011
Chapters 12 – 16

Name _____

Write and sign the VU Honor Pledge:

_____
signature

This exam is closed book and closed notes

NOTE: It is difficult for me to give you partial credit if you do not show your work!

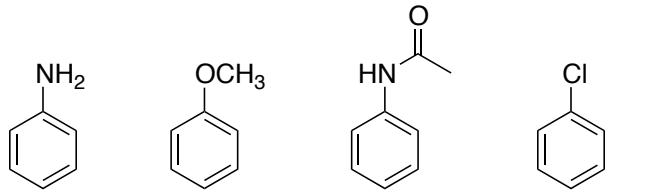
Neatness count

Stereochemistry counts are indicated

Good Luck !!

1-14. Multiple choice. Choose the *best* answer for the following questions (4 pts each, 56 pts)

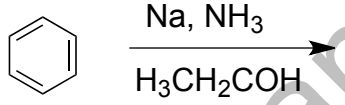
1. Which of the following statements about aniline, anisole, acetaniline, and chlorobenzene is true?



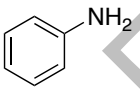
aniline anisole acetaniline chlorobenzene

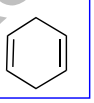
a) All will undergo electrophilic aromatic substitution faster than benzene.
b) All possess ortho/para directing groups.
c) All are suitable substrates for Friedel-Crafts acylation reactions.
d) a, b, and c are all true.

2. Choose the product of the following reaction.



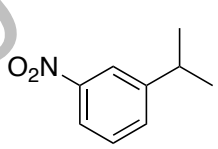
a) 

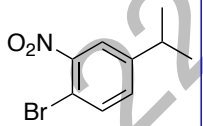
b) 

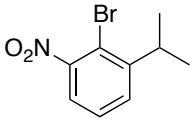
c) 

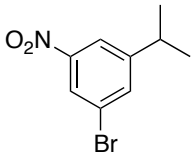
d) 

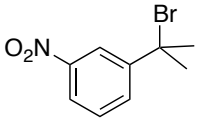
3. Predict the *major* product from the electrophilic bromination of 3-nitro-(1-methylethyl)-benzene (shown below).



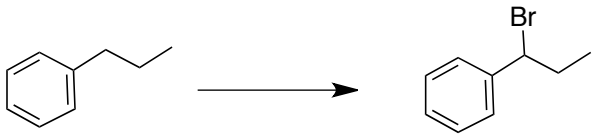
a) 

b) 

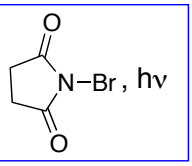
c) 

d) 

4. Choose the best reagent for the following reaction.



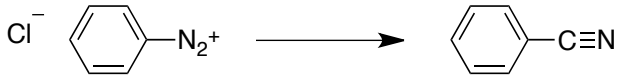
a) HBr, H_2O_2

b) 

c) Br_2, $FeBr_3$

d) Br_2, H_2O

5. Which reagent or sequence of reagents will convert benzenediazonium chloride to cyanobenzene?



a) KCN, $AlCl_3$

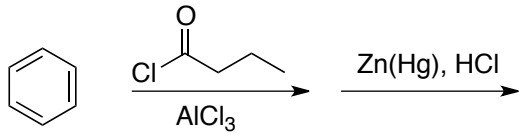
b) NH_3

c) CuCN

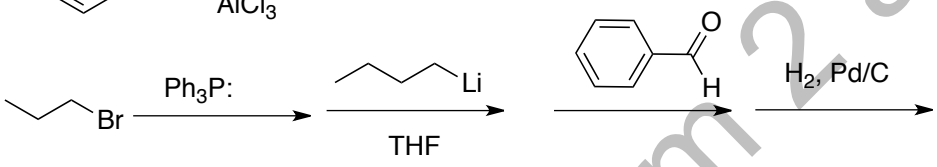
d) 1) NBS; 2) NaCN, DMSO

6. Which of the following sequences is a viable way to synthesize butylbenzene.

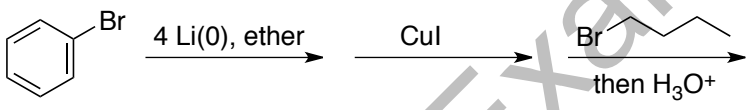
a)



b)



c)



d) a, b, and c are all viable sequences to synthesize butylbenzene

7 Which is the best reagent for the following reaction?

a) H_2, Pd/C

b) $LiAlH_4$, ether; then HCl

c) Zn, H_3O^+

d) a, b, and c will work equally well

8. Which reagent or sequence of reagents can be used to synthesize aniline from benzene?

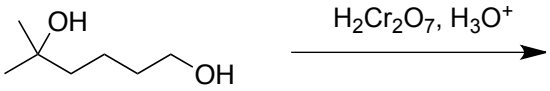
a) H_2NNH_2, KOH, Δ

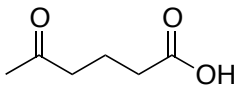
b) 1) Br_2, $FeBr_3$; 2) NH_3

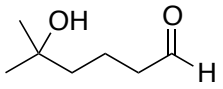
c) 1) $NaNO_2$, HCl; 2) Sn, HCl

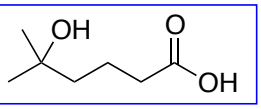
d) 1) HNO_3, H_2SO_4; 2) H_2, Pd/C

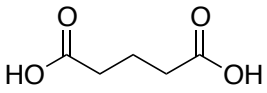
9. Predict the product of the following reaction.



a) 

c) 

b) 

d) 

10. The most diagnostic spectroscopic method for the presence of an aldehyde is . . .

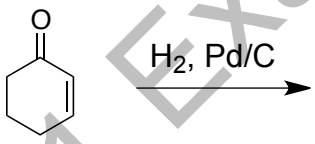
a) a ^{1}H NMR resonance between δ = 9 – 10 ppm.

b) a ^{13}C NMR resonance between δ = 165 – 220 ppm.

c) an infrared absorbance between 1700 – 1750 cm^{-1}.

d) a weak UV absorbance at 260 nm with a small extinction coefficient (ε).

11. The carbonyl absorbance in the IR spectrum of cyclohexenone is at 1685 cm^{-1}. Upon catalytic hydrogenation of cyclohexenone, the carbonyl absorbance of the product . . .



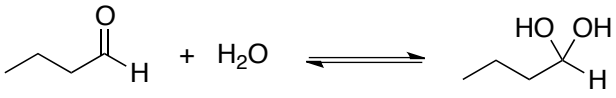
a) . . . is expected at 1685 cm^{-1}.

b) . . . is expected at 1655 cm^{-1}.

c) . . . is expected at 1715 cm^{-1}.

d) . . . is expected to disappear and a new broad absorbance between 3000-3500 cm^{-1} will be present.

12. The equilibrium constant for the hydration of butanal is 0.6. The addition of an acid catalyst . . .



a) . . . will dramatically shift the equilibrium toward the hydrate (K_{eq} is very large).

b) . . . will dramatically shift the equilibrium toward butanal (K_{eq} is very small).

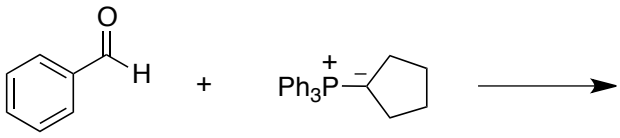
c) . . . will result in a 50:50 mixture of butanal and its hydrate (K_{eq} = 1).

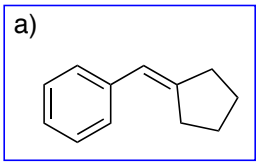
d) . . . does not change the equilibrium (K_{eq} = 0.6).

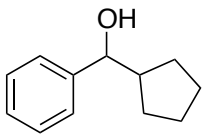
13. Which is the best reagent for the oxidation of 1-pentanol to pentanal.

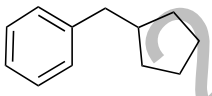
a) $H_2Cr_2O_7$, H_3O^+ b) CrO_3, pyridine c) $NaBH_4$, H_3COH d) O_3, then Zn, H_2O

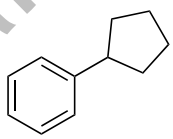
14. Choose the major product from the following reaction.



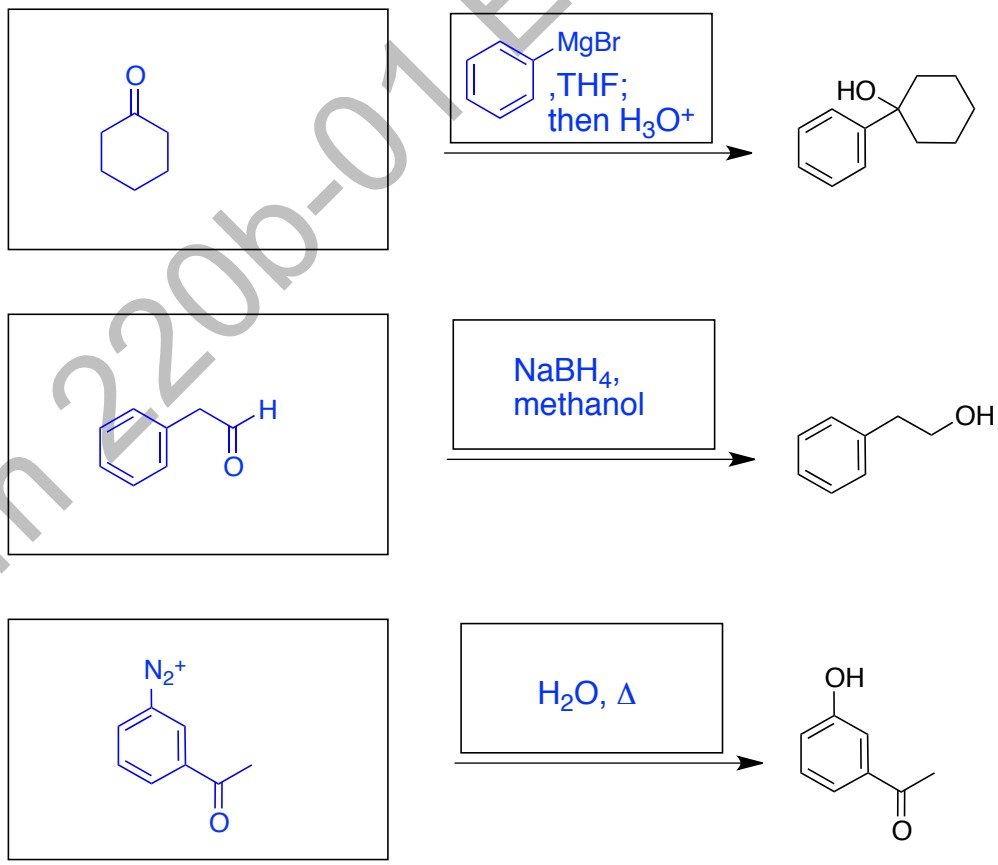
a) 

b) 

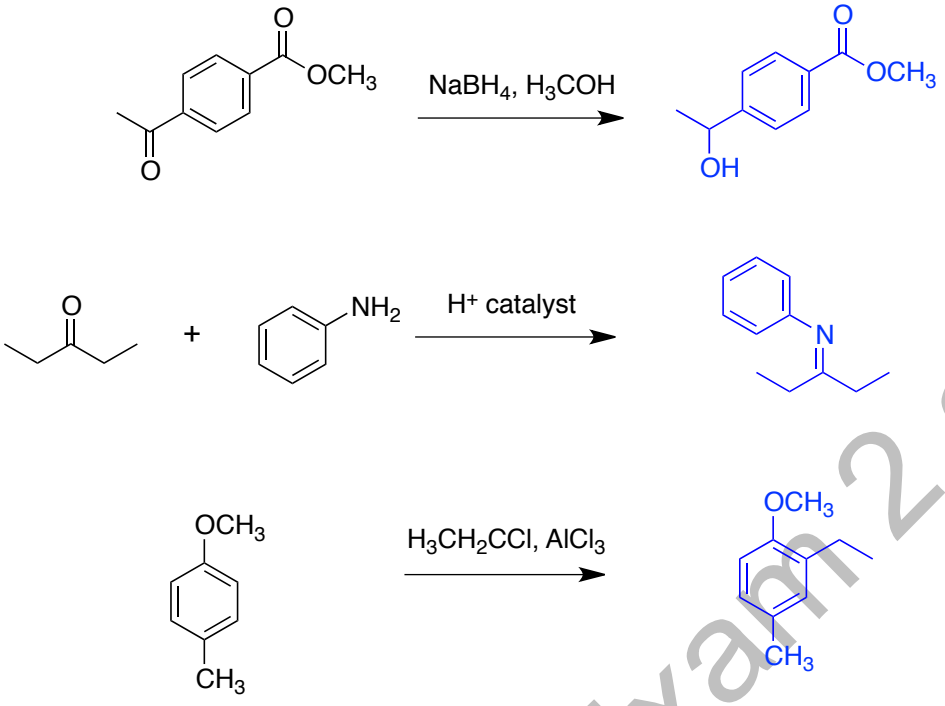
c) 

d) 

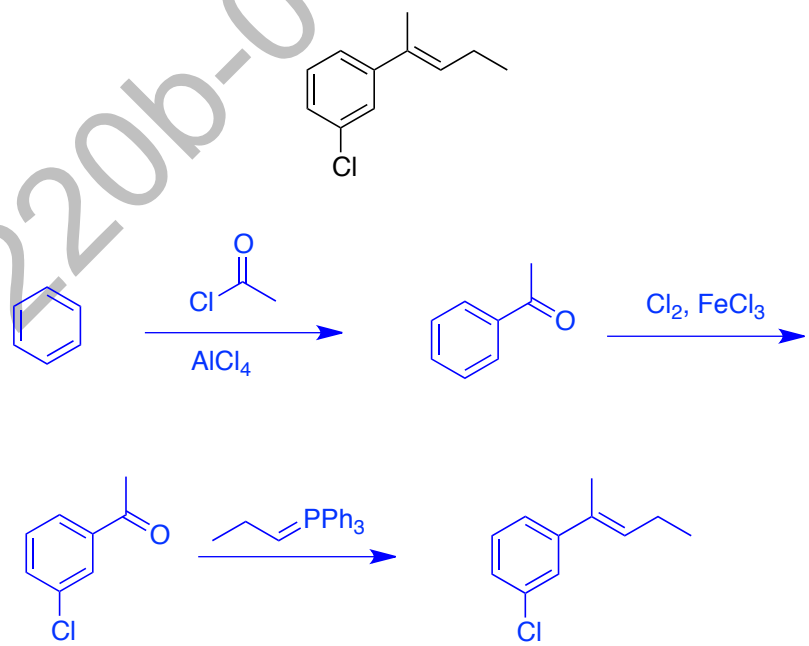
15. Provide a suitable starting compound and reagent(s) to prepare the following target compounds. (12 pts): other answers may be acceptable.



16. Provide the *major* product of the following reactions. (12 pts)

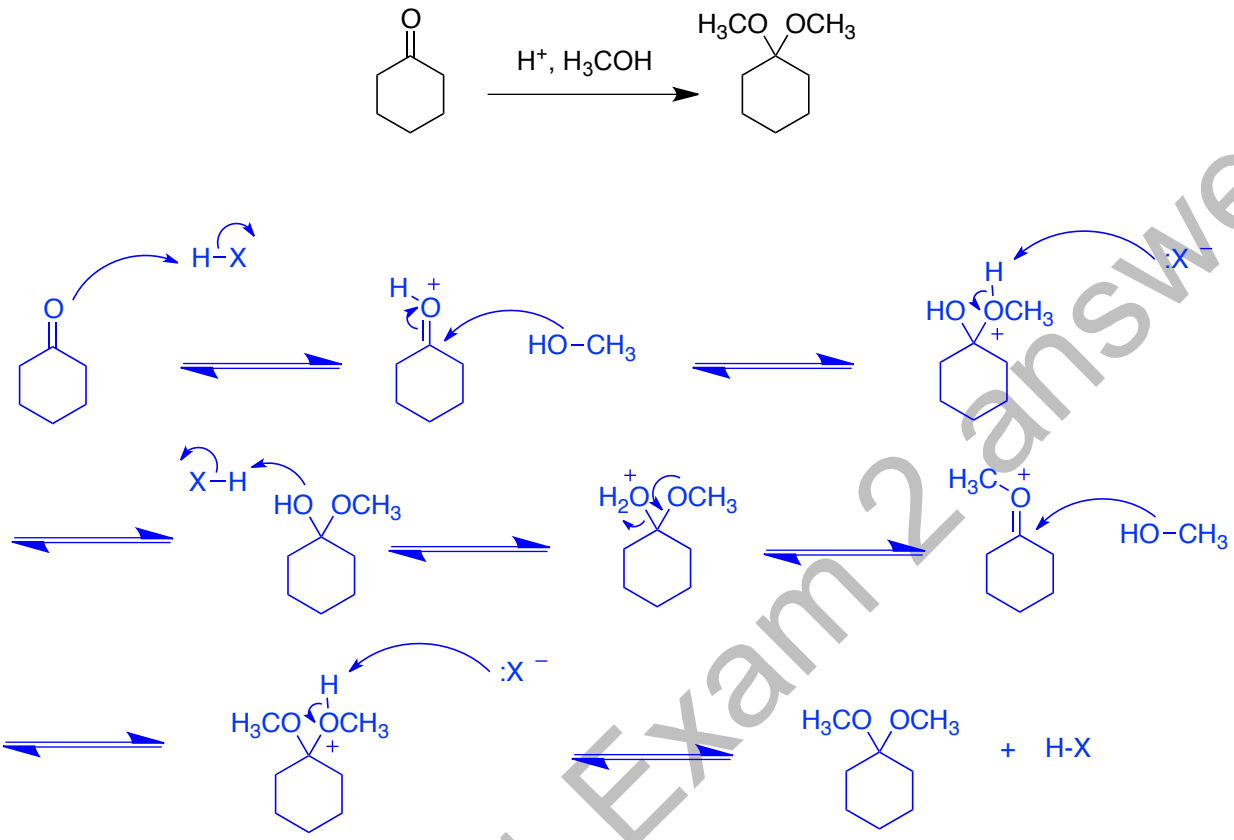


17. Synthesize the target compound below starting from benzene, any primary alkyl halide (including iodomethane), any organometallic reagent or Wittig reagent derived from a primary alkyl halide (including iodomethane), any acid chloride, and any inorganic reagents. *Remember, brevity is the soul of wit and organic synthesis* (10 pts)



other answers may be acceptable

18. Provide a complete mechanism for the acid-catalyzed reaction of cyclohexanone and methanol to afford 1,1-dimethoxycyclohexane. (10 pts)



Problem 1-14:_____ (56 pts)

15:_____ (12 pts)

16:_____ (12 pts)

17:_____ (10 pts)

18:_____ (10 pts)

Total out of 100: _____