Hour Exam #1
Chemistry 345
Professor Gellman
18 February 2009

Last Name Answer

First Name Key

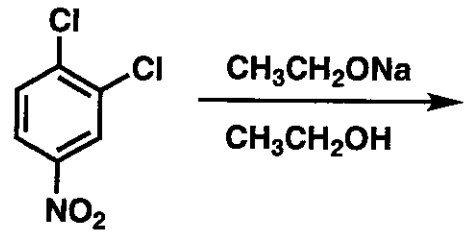
General Instructions:

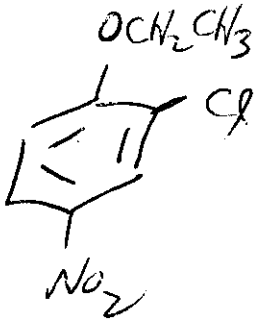
(i) Use scratch paper at back of exam to work out answers; final answers must be recorded at the proper place on the exam itself for credit.

(ii) Print your name on each page.

1. (18 points) Show the major product or products expected from each reaction:

(a)

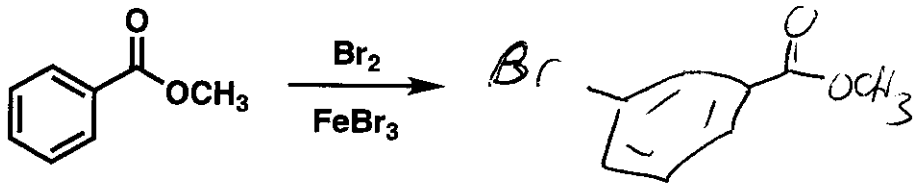




+6

(-3 for disubstituted)
0 for only di

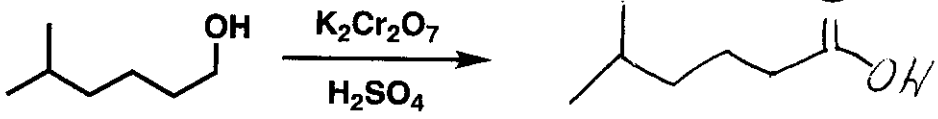
(b)



+6

(-3 for disubstituted)
zero for only di

(c)



+6

(+3 for aldehyde instead)

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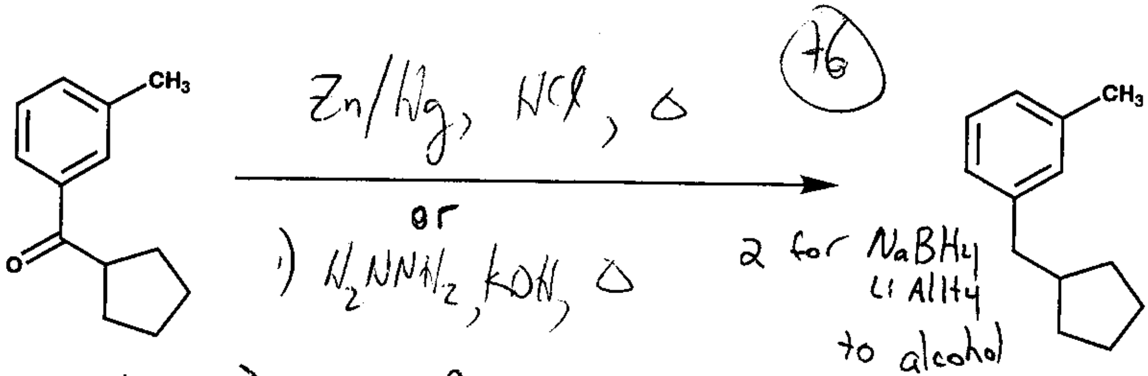
Name ______________

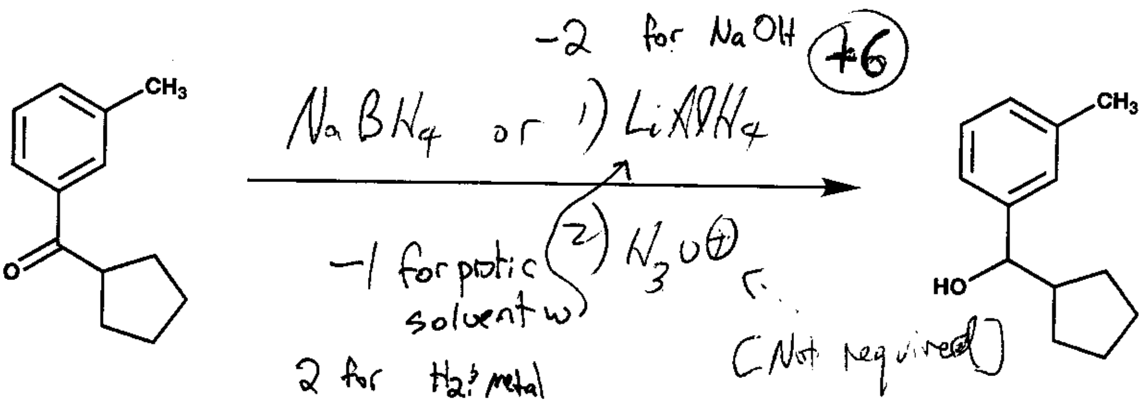
2) ([redacted] points) Show the reagents and other organic molecules required to convert the starting molecule into the indicated product. Be sure to differentiate clearly between distinct steps, by using "1)," "2)," etc. over the arrow. Use the minimum number of reactions.

(a)

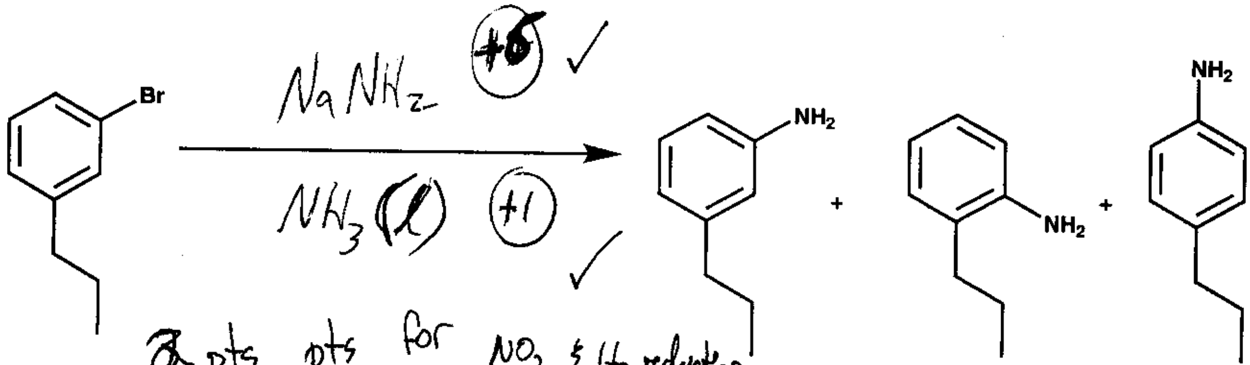


(Not required) ---> HO~~O~~OH

(b)



(c)



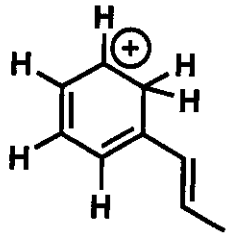
2 pts pts for NO2 & H2 reduction

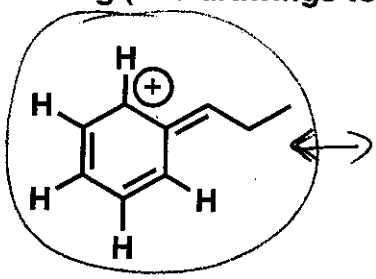
−1 for extra steps

Name _____

3. (24 points) For each pair of isomers below, CIRCLE the one you expect to be more stable. Briefly explain your reasoning (use drawings to make your explanation succinct, when possible).

(a)



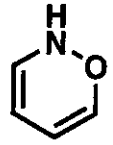


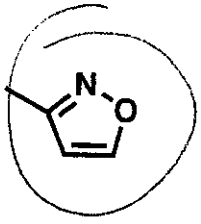
This cation is aromatic; the other is not.

+1 for each correct circle

+7 for each correct explanation.

(b)

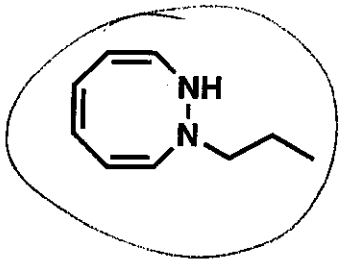


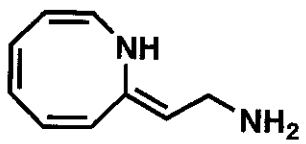


-2 ~~flat~~ miscounting π e⁻ but saying aromatic

This molecule is aromatic (6 π e⁻ in ring — two π-bonds and 0 lone pair). The other is not (8 π e⁻ in ring).

(c)





This molecule is aromatic (10 π e⁻ in ring — three π-bonds and lone pairs from each N).

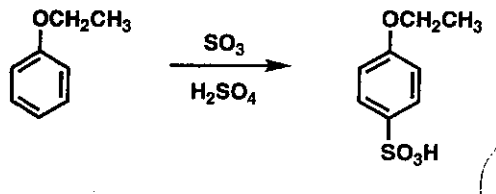
The other is not aromatic.

27

Name _____

4. (points) Draw out a mechanism ("curved arrows") for formation of each reaction shown below. Be sure to show all important resonance structures in intermediates.

(a)



+2 for arrows

+2 for intermediate

this arrow is not shown w/ that res. form

+2 for arrows

+1 for each res. structure

-3 for

-1 ; F

+2 for arrows

[+12 total]

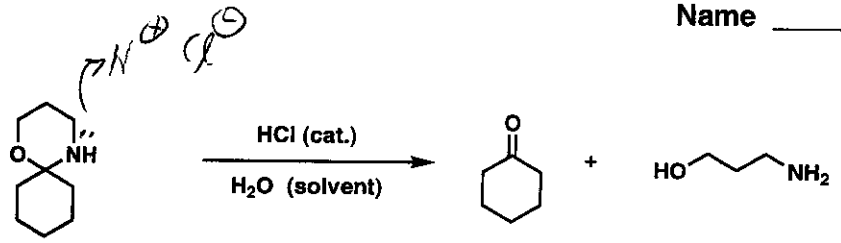
-- cont. on next page --

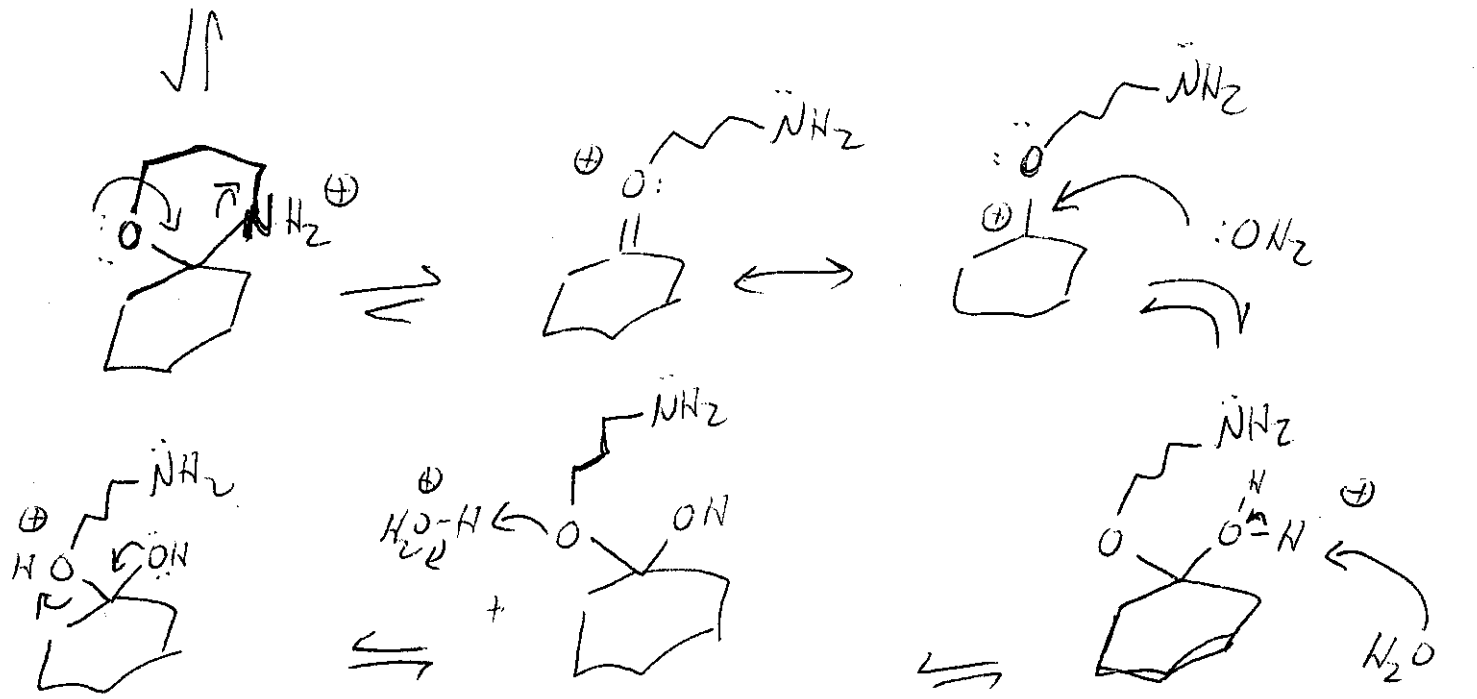
~~+ For incorrect arrows~~

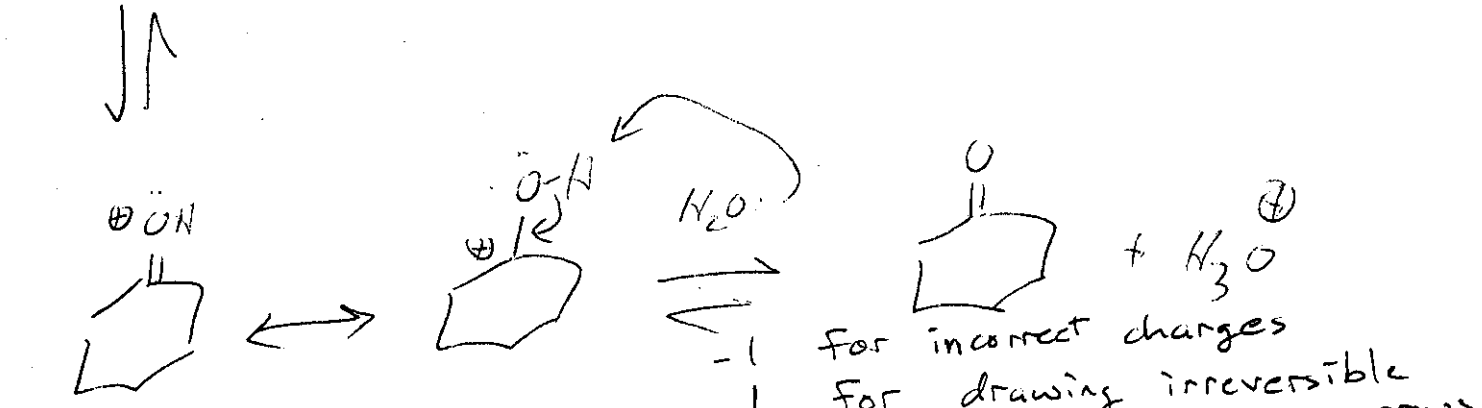
Name _____

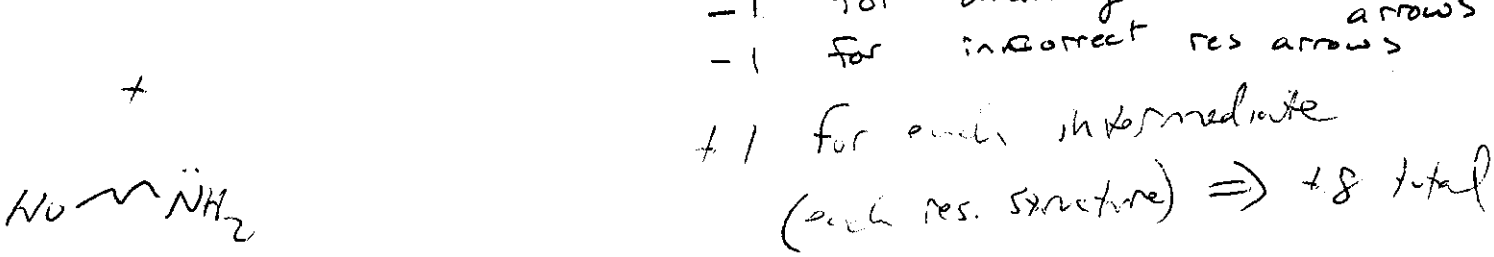
4. (cont.)

(b)









+

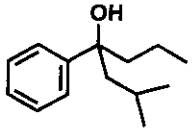
- 1 for incorrect charges
- 1 for drawing irreversible arrows
- 1 for incorrect res arrows

+ 1 for each intermediate (each res. structure) ⇒ +8 total

+ 1 for each set of mechanistic arrows (one or two) ⇒ + 7 total

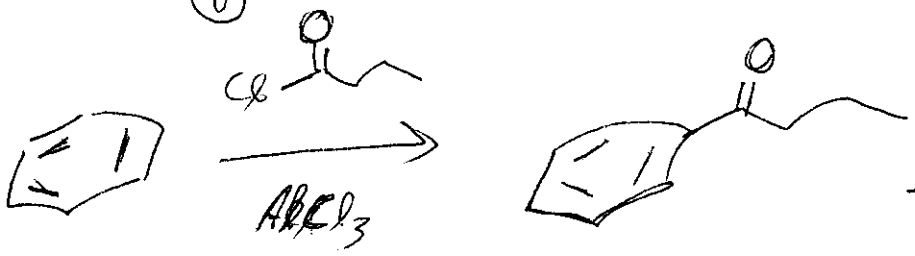
Name _____

5. (12 points) Propose a synthesis of the target molecule from benzene and any other organic starting materials containing ≤ 4 carbon atoms. Try to identify a route that has as few steps as possible.

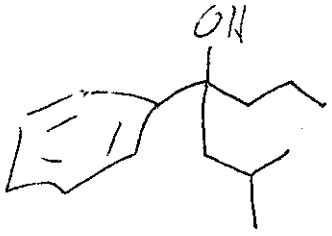
Target: 

[Grignard ok]

+6



+6



Alternative (longer!) [several variations possible] – +10