CHEM 112B *Instructor: Felix Fischer*
Spring 2014

Midterm Examination I Answer Key

Thursday, February 20, 2014

Name:	_____
Student ID:	_____
GSI:	_____

(1)	_____	16 points
(2)	_____	16 points
(3)	_____	20 points
(4)	_____	16 points
(5)	_____	12 points
(6)	_____	10 points
(7)	_____	10 points
Total	_____	100 points

YOUR EXAM SHOULD HAVE **17** PAGES

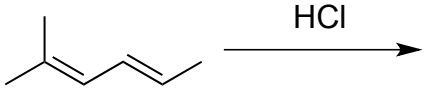
NOTE 1: PLEASE START BY WRITING YOUR NAME AND STUDENT ID ON THE COVER PAGE AND YOUR INITIALS ON THE TOP RIGHT OF EACH OF THE OTHER PAGES.

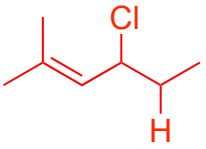
NOTE 2: PLEASE WRITE ALL ANSWERS IN THE SPACES PROVIDED. ONLY THESE WILL BE GRADED. IF YOU NEED MORE SPACE USE THE THREE SCRATCH PAPERS PROVIDED ON PAGE 15-17.

NOTE 3: PLEASE WRITE AND DRAW CLEARLY.

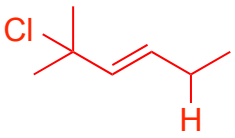
1) (16 points) Draw the major 1,2- and 1,4-addition products of the following reactions? For each reaction indicate the kinetic and the thermodynamic products.

(a)



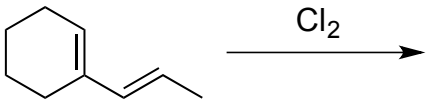


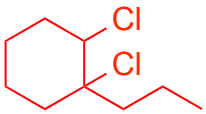
kinetic



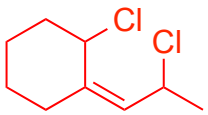
thermodynamic

(b)



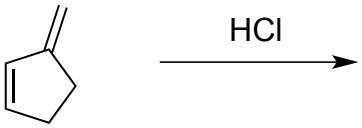


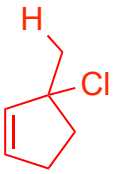
kinetic



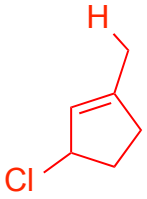
thermodynamic

(c)



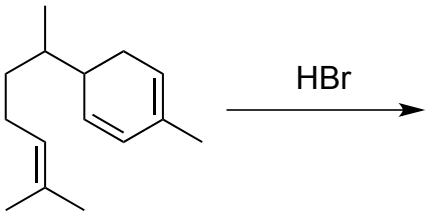


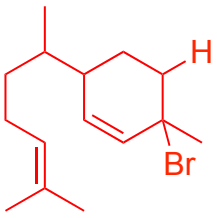
kinetic



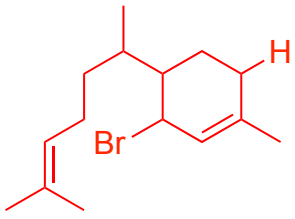
thermodynamic

(d)





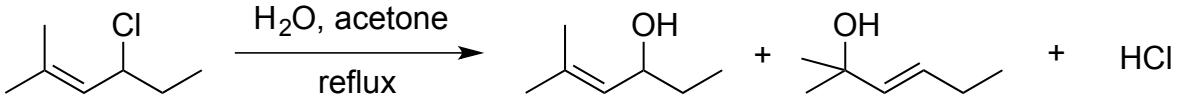
kinetic

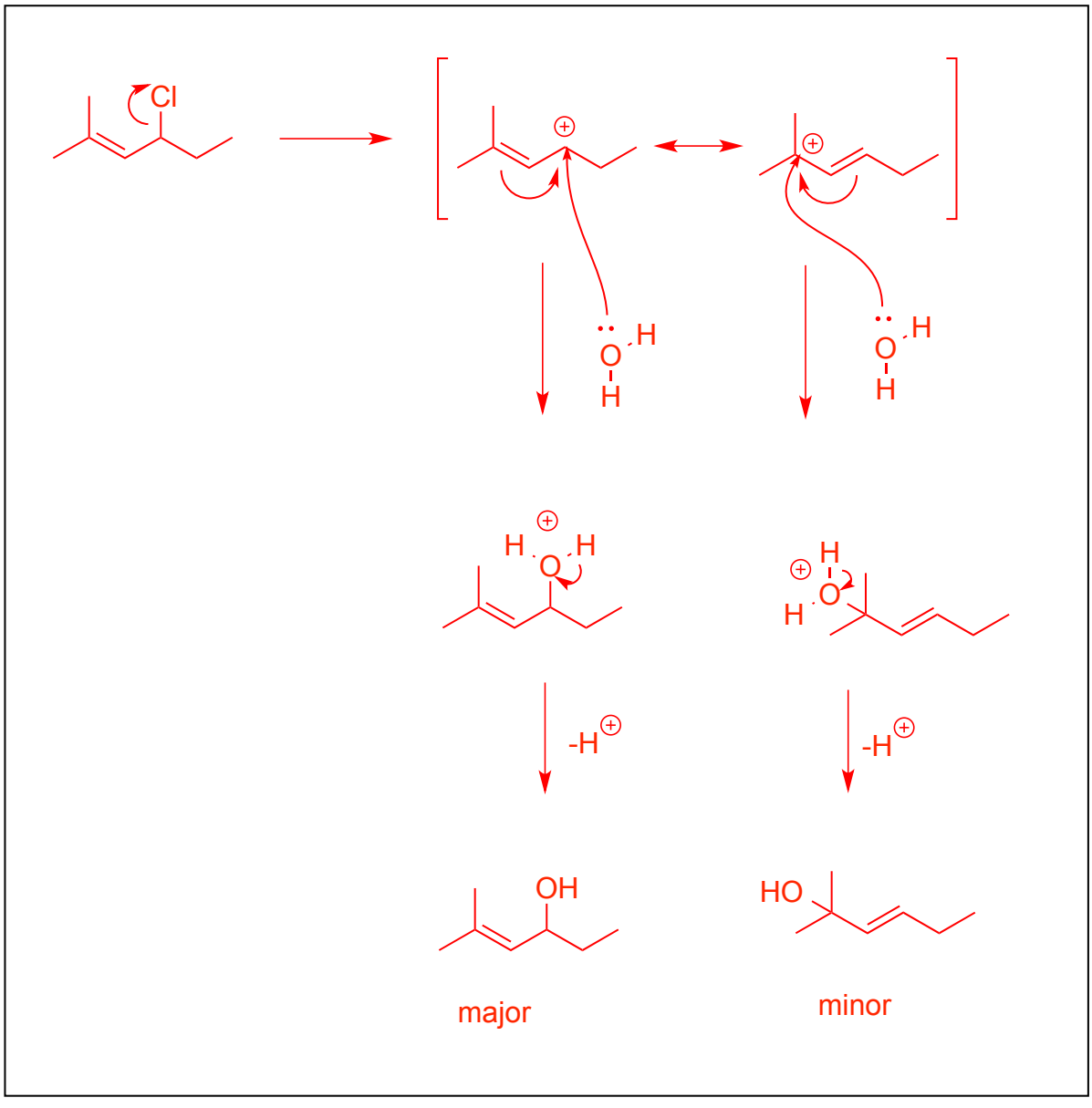


thermodynamic

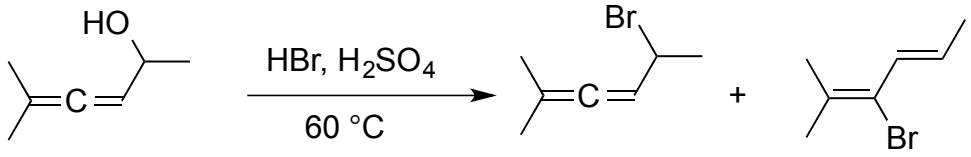
2) (16 points) Suggest a reaction mechanism for each of the following reactions that accounts for both products. Use clear arrow pushing and draw all intermediates, and resonance structures. Indicate the minor and major product.

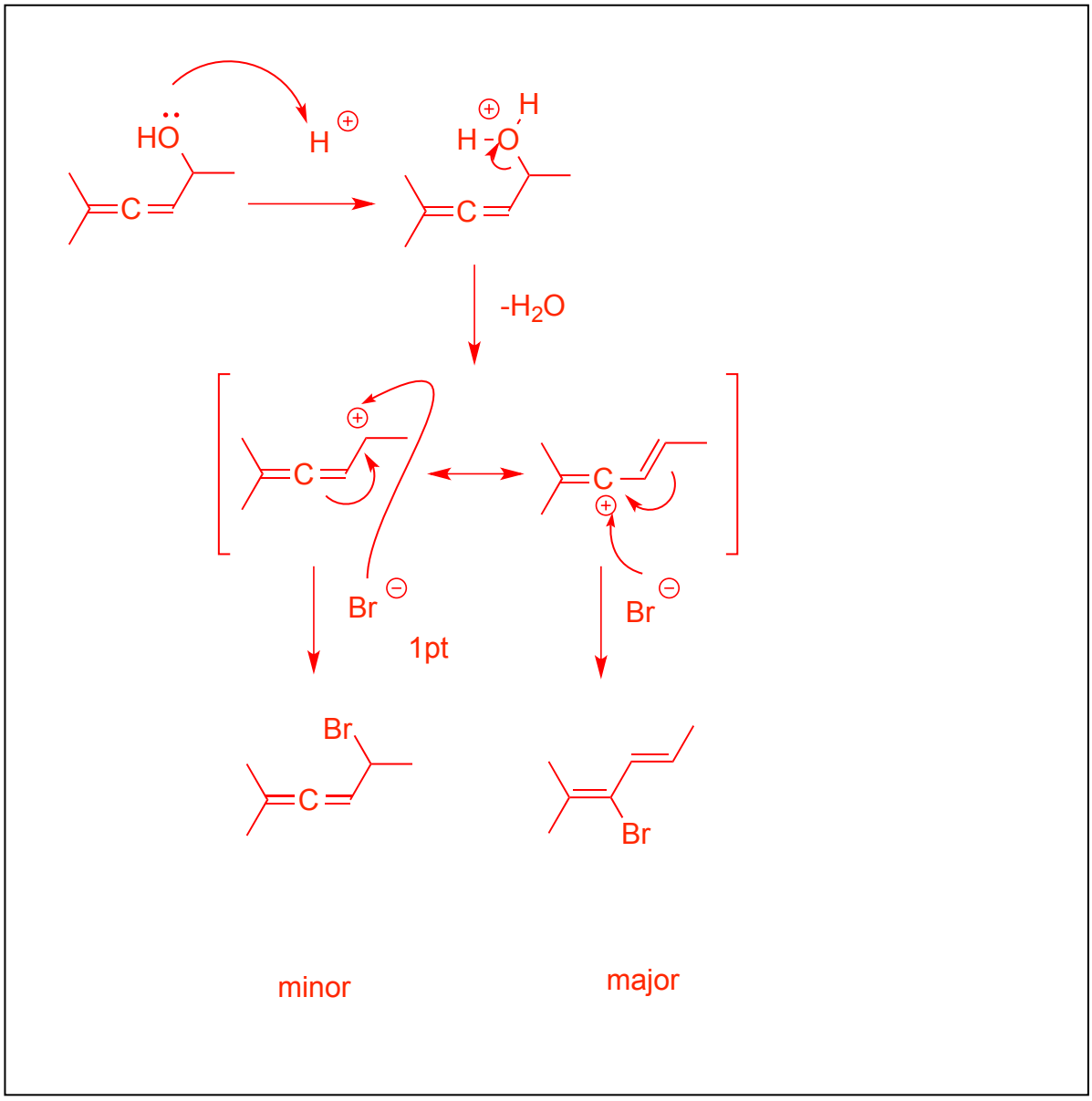
(a)





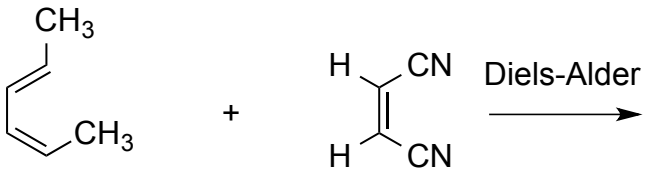
(b)

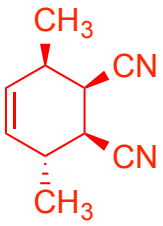


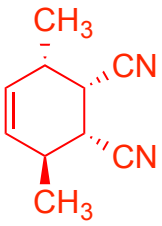


3) (20 points) Draw all the products formed in the following Diels-Alder reactions. Clearly indicate the stereochemistry in the products. If a racemic mixture of products is formed you only need to draw one enantiomer. Indicate the racemic mixture with a "(+/–)" sign.

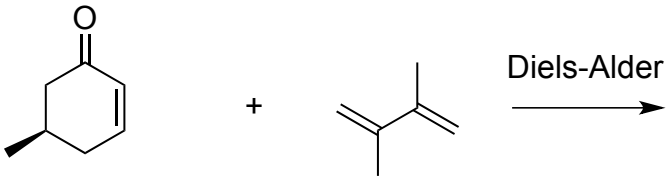
(a)

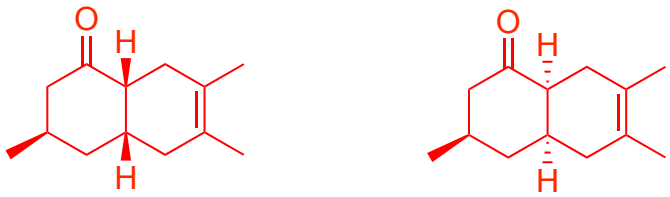




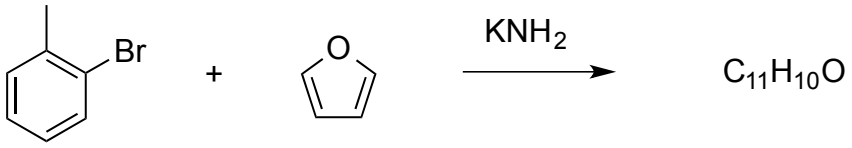


(b)

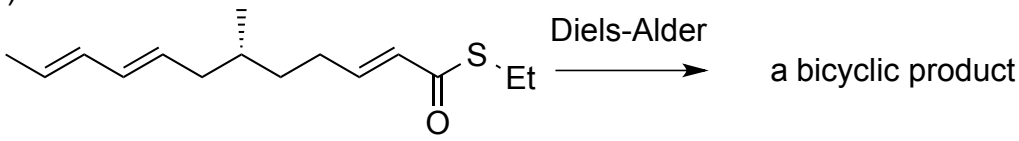


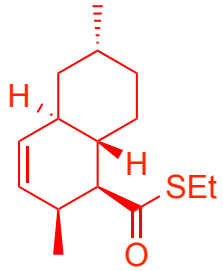


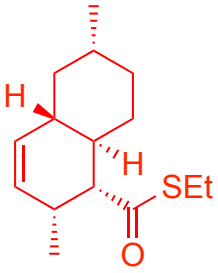
(c)

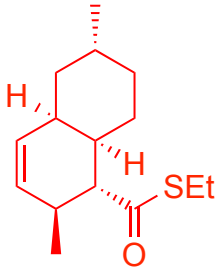


(d)





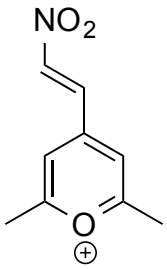




exo products not required for credit

4) (16 points) Using the Hückel rules determine whether each of the following compounds is aromatic, antiaromatic, or non-aromatic.
Explain your choice in less than 20 words.

(a)



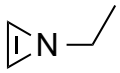
aromatic

planar

conjugated

6π→4n+2π

(b)

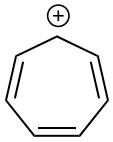


non-aromatic

planar

not conjugated: N atom is sp^3 hybridized
4nπ antiaromaticity avoided

(c)



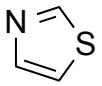
aromatic

planar

conjugated

6π→4n+2π

(d)



aromatic

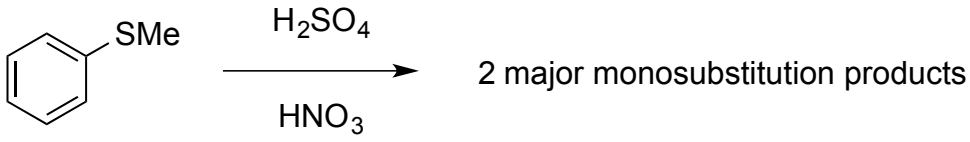
planar

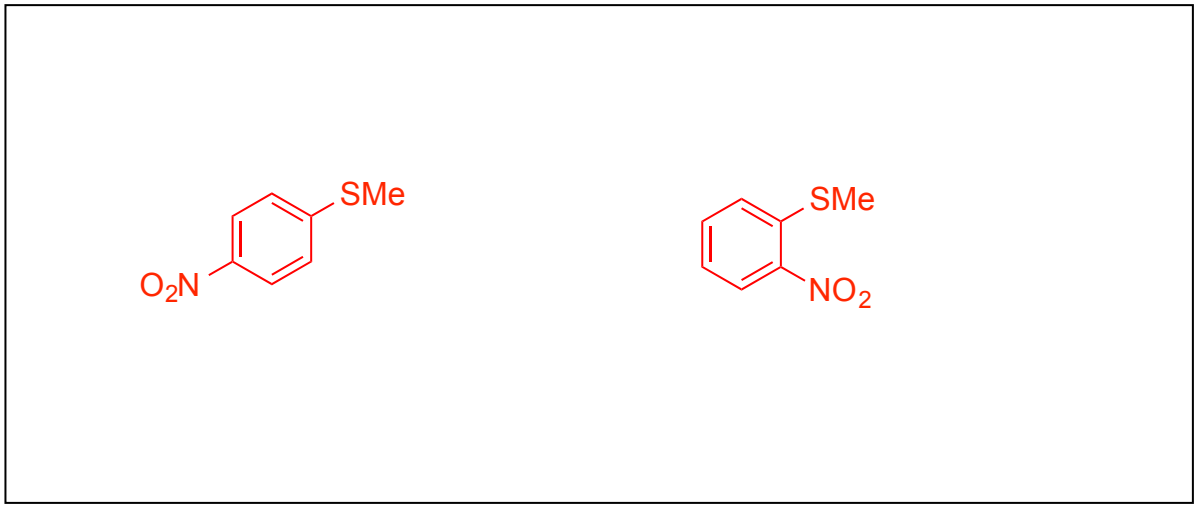
conjugated

6π→4n+2π

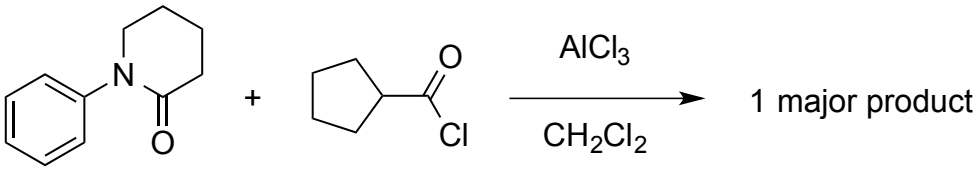
5) (12 points) Predict the major products of the following reactions.

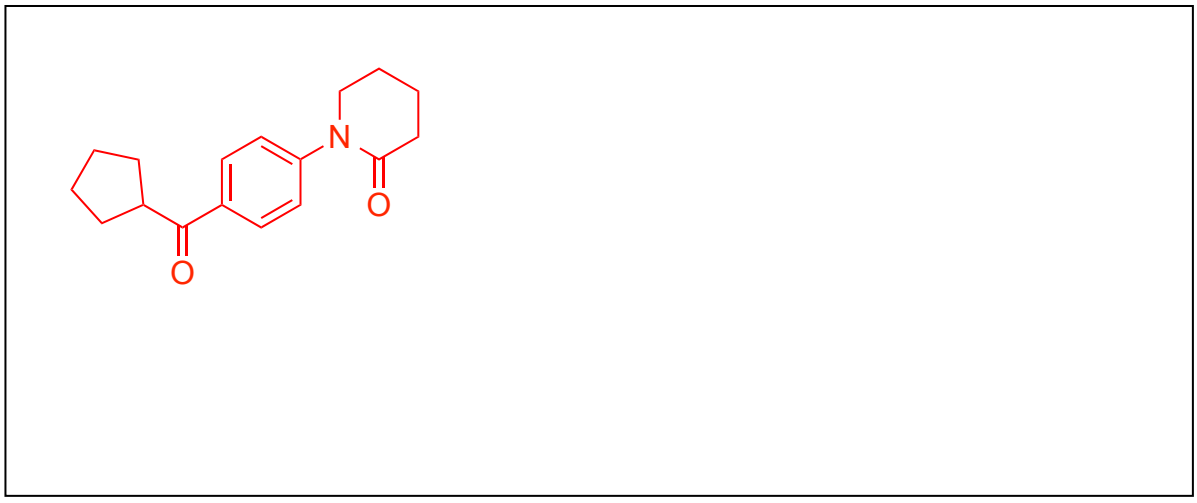
(a)



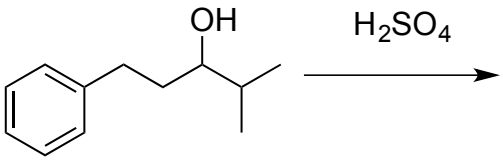


(b)

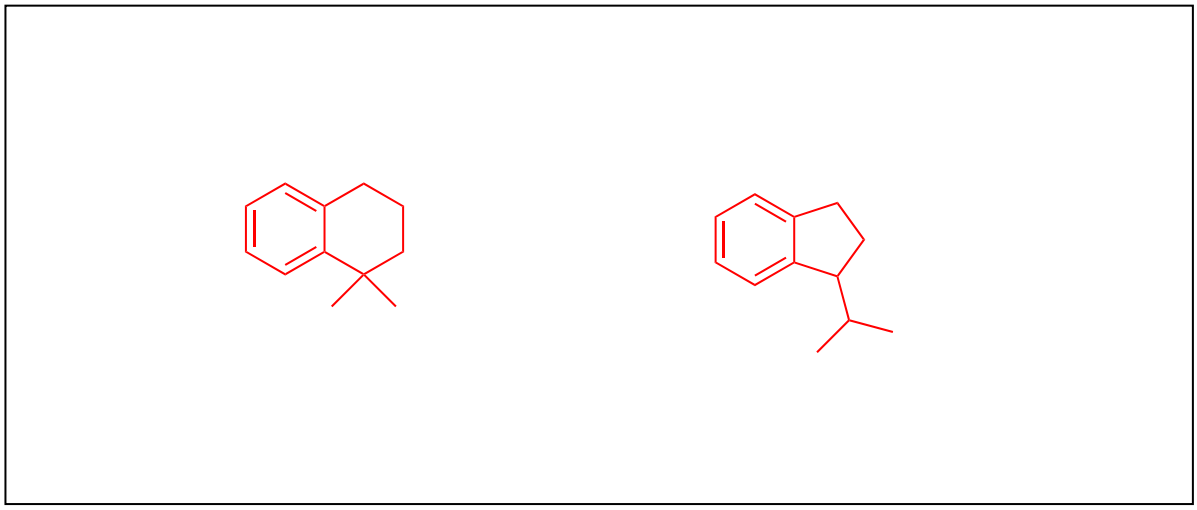




(c)

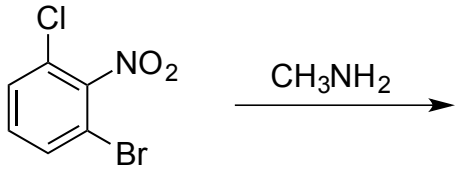


2 products resulting from
electrophilic aromatic substitutions

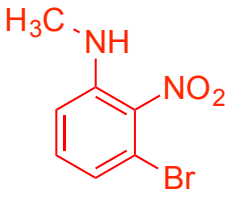


6) (10 points) Identify the products of the following reactions. Draw a detailed curved arrow mechanism that leads to the major product. Clearly indicate resonance structures, and charges in the intermediates

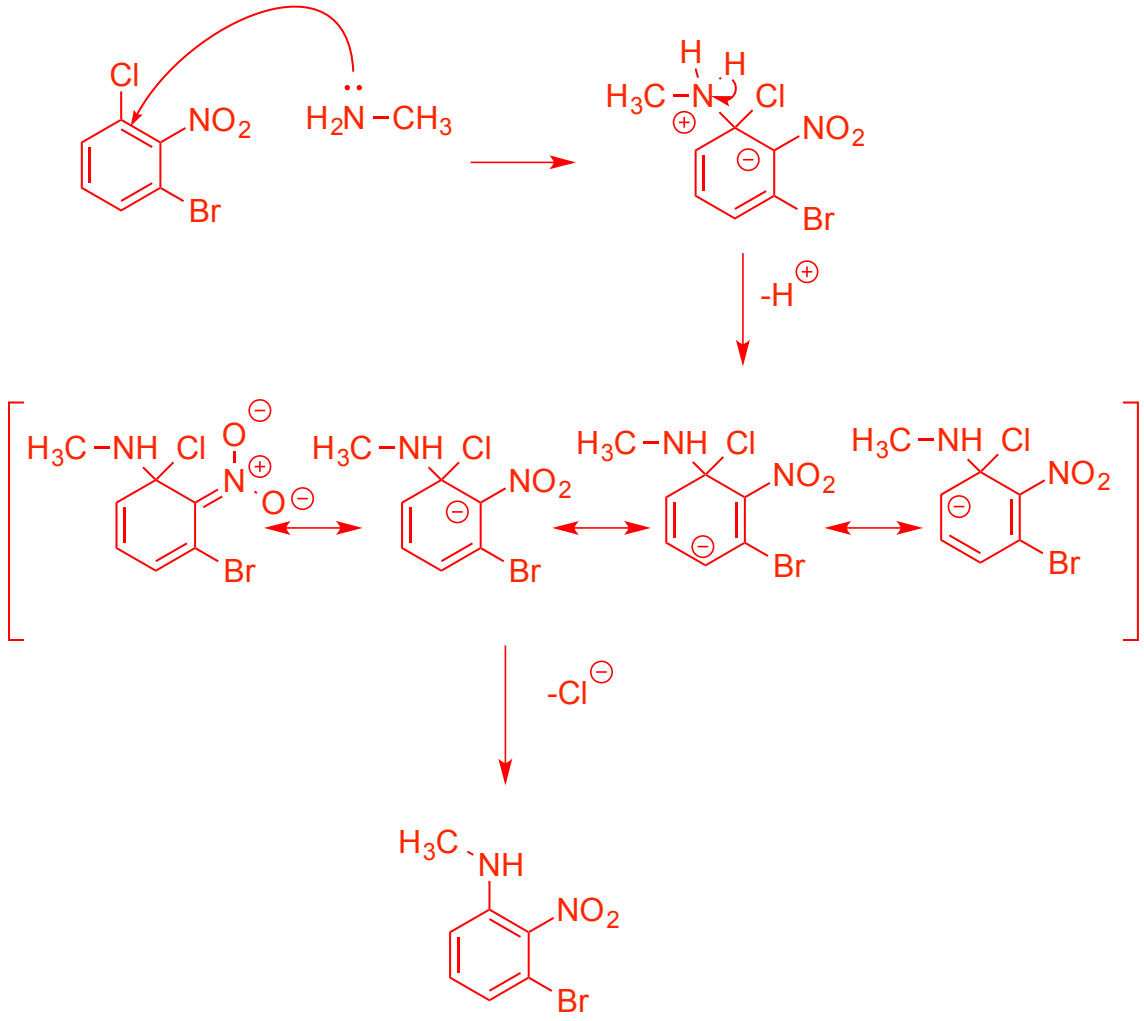
(a)



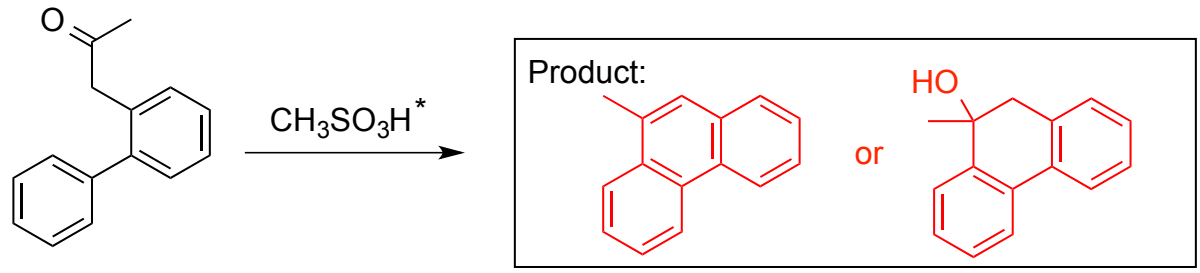
Product:



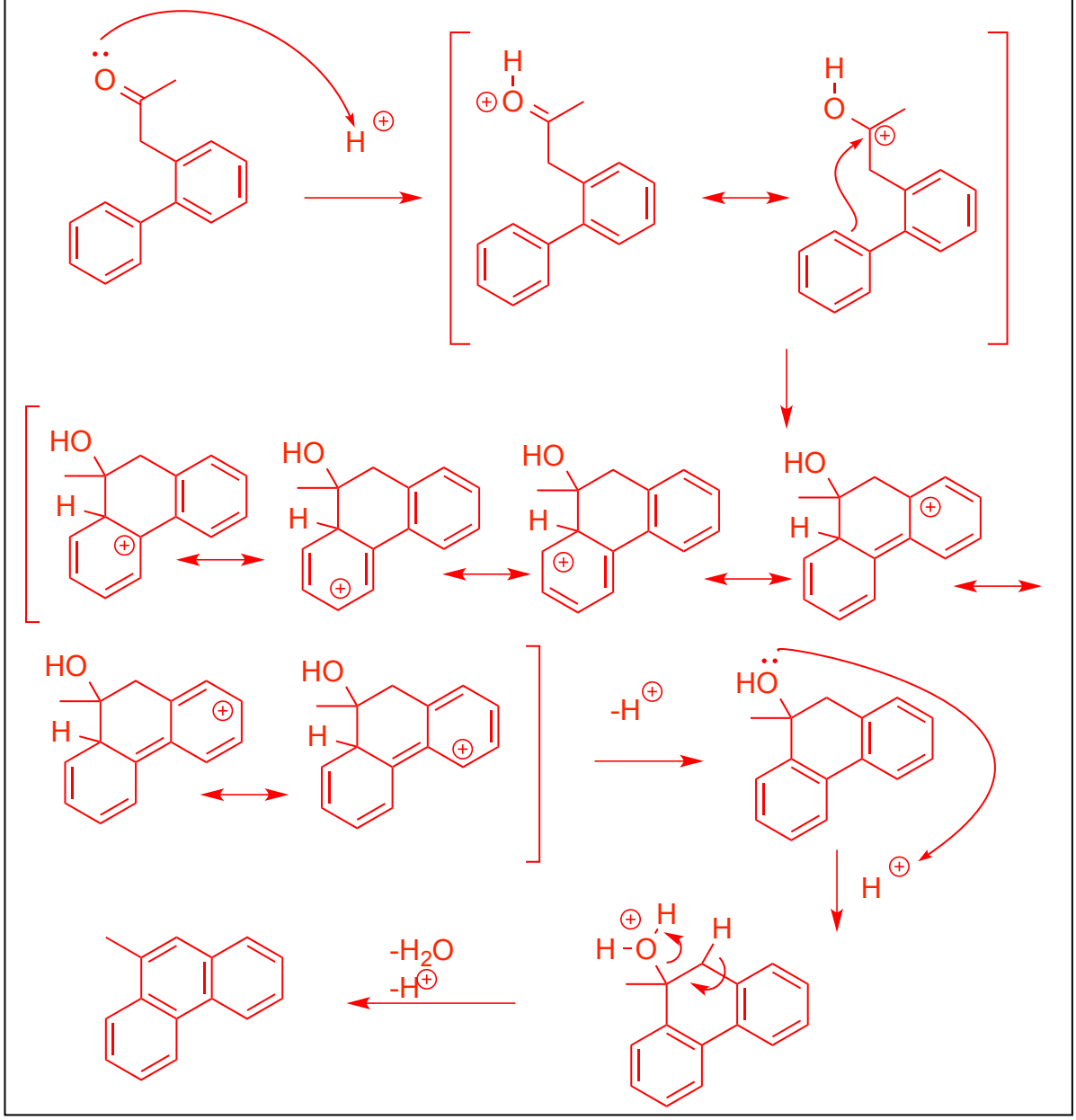
Mechanism:



(b)

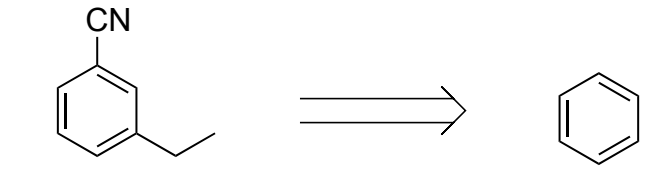


Mechanism:

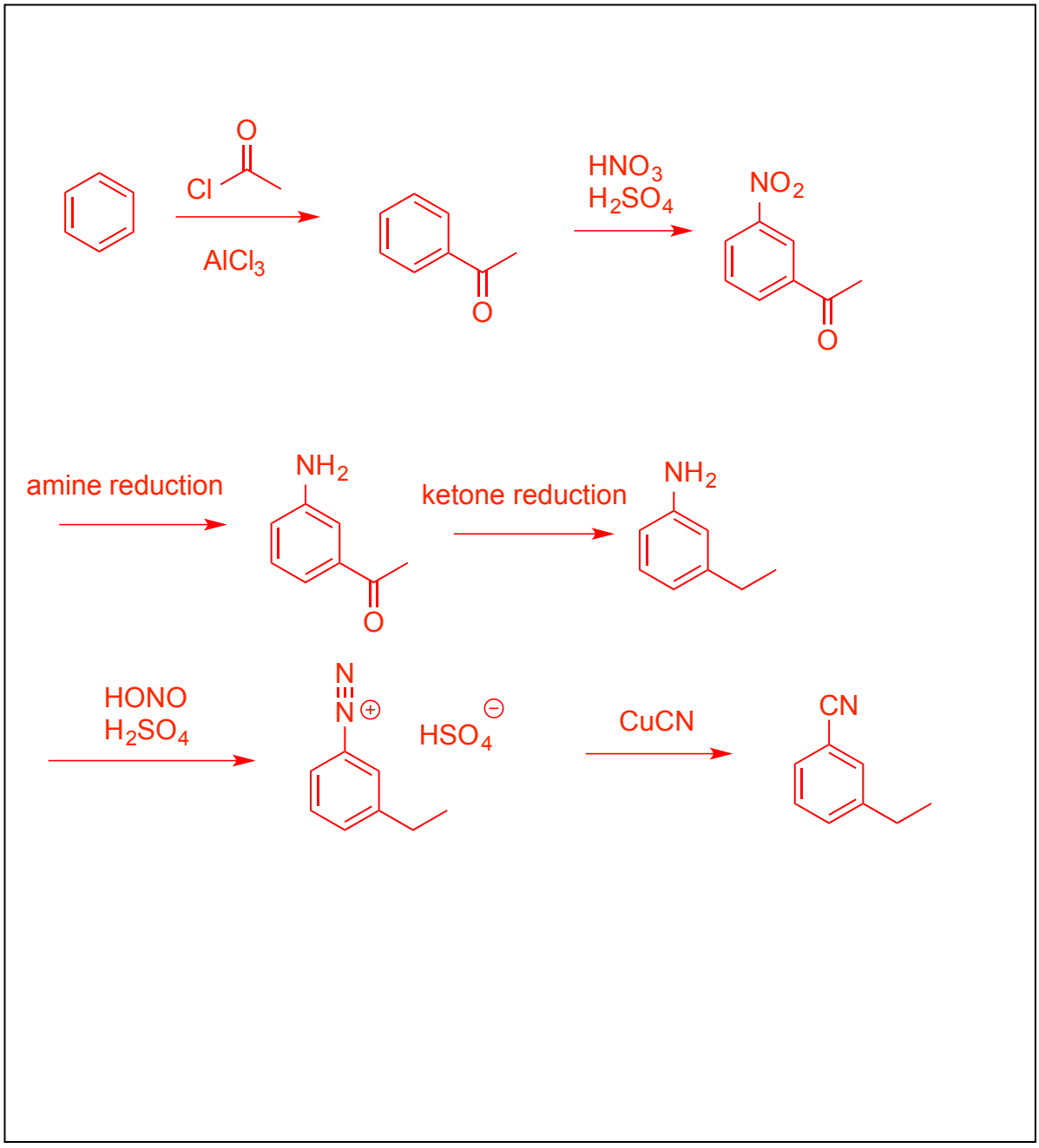


hint: * is a strong acid that is soluble in organic solvents

7) (10 points) Propose a reasonable synthesis of 3-ethylbenzonitrile starting from benzene and any other inorganic or organic reagent with two or less carbon atoms.



3-ethylbenzonitrile



Scratch Paper:

Scratch Paper:

Scratch Paper: