

**Name:**

**Organic Chemistry 152L – Spring 2010**  
**Instructor: Don Coltart**

*Exam 1*

February 16, 2010

***Turn off all cell phones, beepers, pagers, etc.***

- *Please write your name at the top of each page.*
- *No electronic devices may be used during this exam, including calculators.*
- *You are encouraged to use molecular models.*
- *You may not bring any scrap paper into this exam; a scrap page for rough work is appended to the exam; work on that page will **not** be graded for credit.*

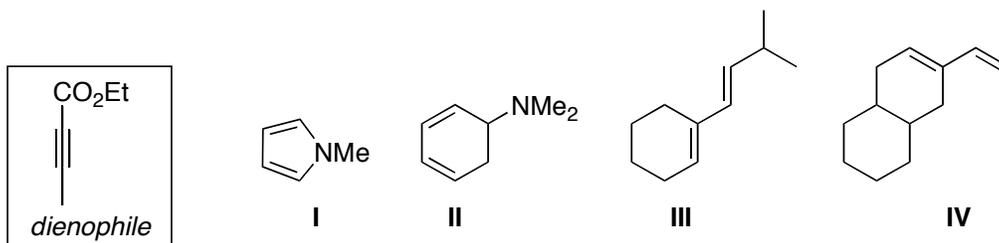
*Please answer all of the following questions on the pages provided. **There are 6 questions in total and some questions have multiple parts.** Provide clear and complete answers and supplement your answers with diagrams and structures where useful and appropriate.*

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Question	Possible Points	Points Scored
1a	6	
b	6	
c	6	
d	6	
2a	6	
b	6	
c	6	
d	6	
3a	18	
b	6	
c	12	
4a	8	
b	4	
c	2	
d	12	
5a	4	
b	16	
c	4	
6a	12	
b	4	
<b>Total</b>	<b>150</b>	

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1) Consider the following dienes, **I** to **IV**, in a Diels-Alder reaction with the dienophile shown and answer the following questions.



a) (6 points) The most reactive compound is? (circle only one)

**I**
                 
  **II**
                 
  **III**
                 
  **IV**

b) (6 points) The least reactive compound is? (circle only one)

**I**
                 
  **II**
                 
  **III**
                 
  **IV**

c) (6 points) **I** is more reactive than **II** because the nitrogen lone pair in **I** is delocalized into the diene double bonds, whereas in **II** there is an intervening  $sp^3$  hybridized carbon between the nitrogen and the diene that prevents conjugation. (circle only one)

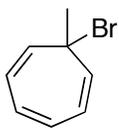
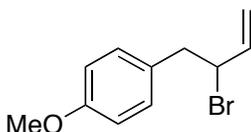
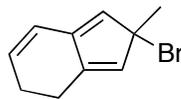
True
                 
  False

d) (6 points) **IV** reacts faster than **III** because the bicyclic ring system in **IV** locks the conformation of the diene. (circle only one)

True
                 
  False

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2) Consider the following compounds, **I** to **IV**, in an  $S_N1$  methanolysis reaction ( $R_3CBr + MeOH \rightarrow R_3COMe + HBr$ ) and answer the questions below.

**I****II****III****IV**

a) (6 points) The **most** reactive compound is (circle only one):

I

II

III

IV

b) (6 points) The **least** reactive compound is (circle only one):

I

II

III

IV

c) (6 points) **III** is more reactive than **IV** because **III** gives an aromatic carbocation. (circle only one):

True

False

d) (6 points) **IV** is more reactive than **II** because the carbocation formed from **IV** is more extensively conjugated. (circle only one):

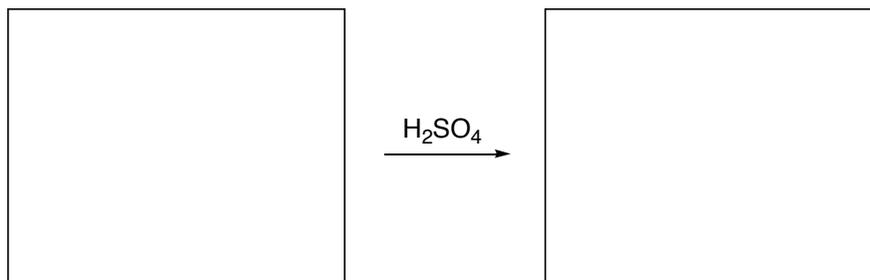
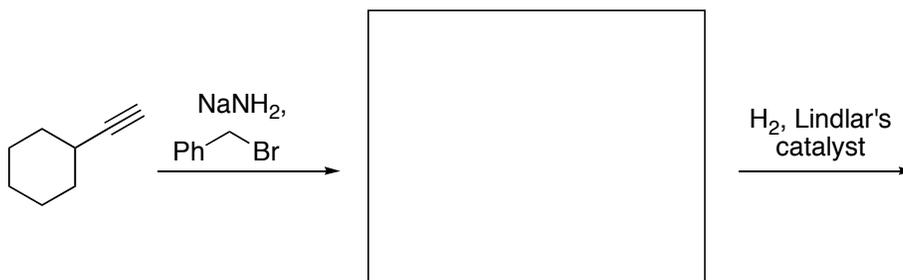
True

False

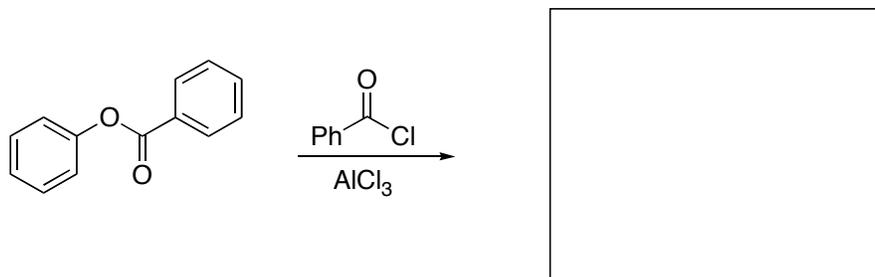
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3) Provide the product of the following reactions. You may assume any neutral, acidic, or basic workup steps required are available to you at each step.

a) (18 points)

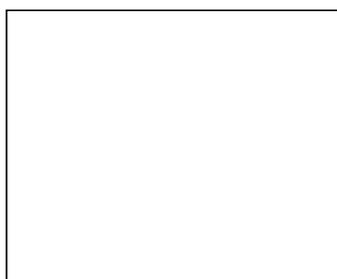
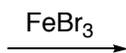
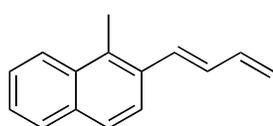
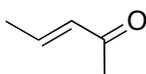


b) (6 points)

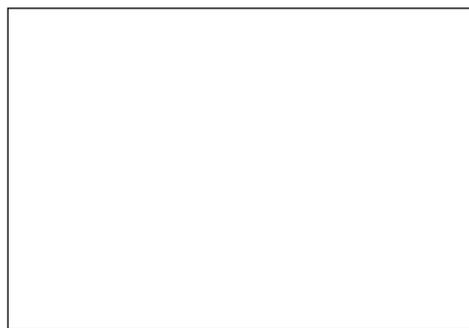
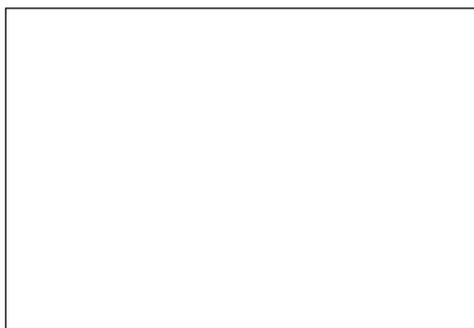


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c) (12 points)

4) When heated together, compounds **A** and **B** undergo a Diels-Alder reaction.**A****B**

a) (8 Points) In the boxes below, draw the structure of the endo and exo (with respect to the C=O group) products formed from this reaction.

b) (4 Points) Write the word **endo** above the box containing the endo diastereomer and the word **exo** above the box containing the exo diastereomer.c) (2 Points) Write the word **major** below the box containing the product that you expect to form to the greatest extent.

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- d) (12 Points) Clearly and neatly draw a three dimensional representation of the transition state that leads to the major product.

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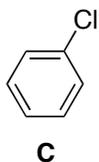
- 5) Consider the following transformation and answer the following questions.



- a) (4 Points) Write the reagents required for this transformation above the reaction arrow.
- b) (16 Points) Using resonance structures and any appropriate stabilizing/destabilizing effects discussed in class, provide a thorough explanation that accounts for the regioselective formation of the *meta*-substituted product over the *ortho/para*-substituted products.

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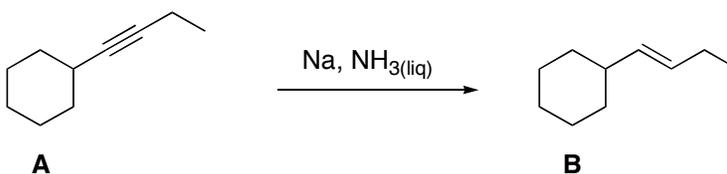
- c) (4 points) Would compound **C** react faster or slower than compound **A** under the same set of reaction conditions shown above?



circle one:

**C** reacts  
faster than **A****C** reacts  
slower than **A**

- 6) When treated with Na and liquid  $\text{NH}_3$  alkyne **A** gives *trans* olefin **B**.



- a) (12 Points) Provide a detailed mechanism for that accounts for the conversion of **A** to **B**.

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b) (4 Points) Provide an explanation for the *trans* selectivity of the reaction.