CHEM 310 Exam 2

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October 1, 2007

Honor Pledge:

In Part V of the Winthrop University Student Conduct Code, it is stated that "A fundamental tenet of all institutions of higher learning is academic honesty. … Misrepresentation of someone else's work as one's own is a most serious offense in any academic setting. … Academic misconduct includes but is not limited to providing or receiving assistance in a manner not authorized by the professor in the creation of work to be submitted for academic evaluation including papers, projects, and examinations …"

By my signature below, I pledge that I did not commit academic misconduct (cheat) on this examination.

KEY
Printed Name

Signature

Part 1 _____/20

Part 2 _____/~~20~~ 17

Part 3 _____/20

Part 4 _____/~~30~~ 33

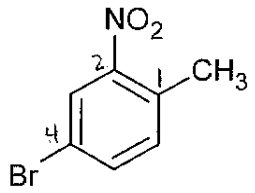
Part 5 _____/10

Total _____/100

Part 1: Nomenclature (20 pts)

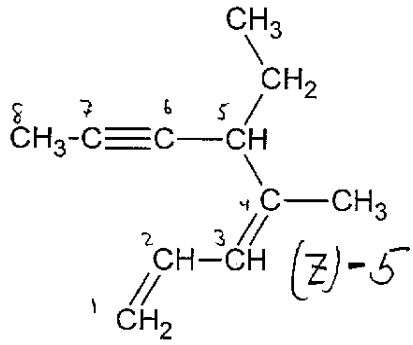
1a. Write IUPAC names for the following compounds (indicate stereochemistry where required):

4 i)



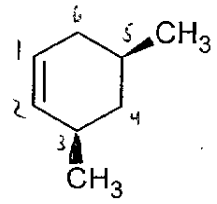
4-BROMO-1-METHYL-2-NITROBENZENE

4 ii)



(Z)-5-ETHYL-4-METHYLOCTA-1,3-DIEN-6-YNE

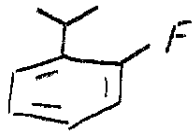
4 iii)



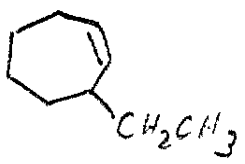
CIS - 3,5-DIMETHYLCYCLOHEXENE

1b. Draw structures corresponding to the following IUPAC names:

4 i) *o*-Fluoroisopropylbenzene



4 ii) 3-Ethylcycloheptene



Part 2: Structure, Stereochemistry and Isomerism (17 pts)

2a. Rank the following set of substituents according to the sequence rules (highest priority = 1, lowest priority = 4).

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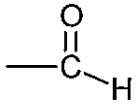
i)  (2)

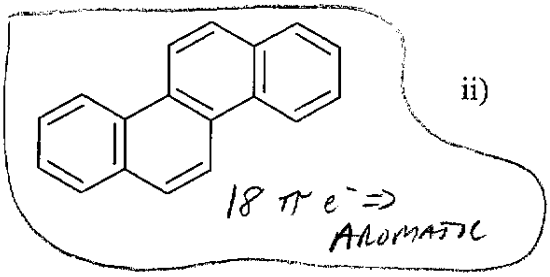
ii) $-CH_2-OH$ (3)

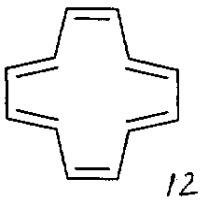
iii) $-Br$ (1)

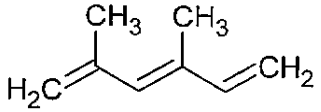
iv) $-CH=CH_2$ (4)

2b. Circle the aromatic compound(s):

6

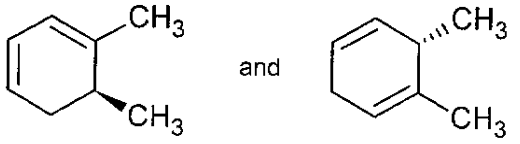
i) 

ii) 
12 π e⁻
NOT AROMATIC

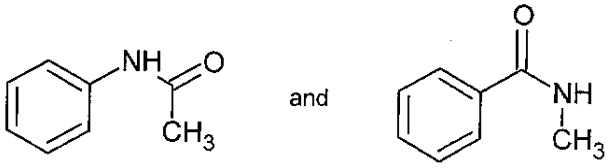
iii) 

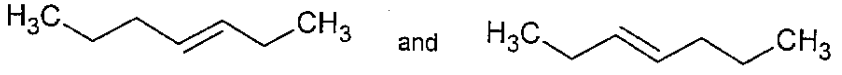
NOT CYCLIC - NOT AROMATIC

2c. Indicate whether the compounds in each pair are *cis-trans* stereoisomers, constitutional isomers, or identical:

i)  CONSTITUTIONAL

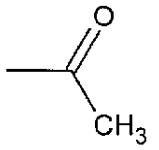
6

ii)  CONSTITUTIONAL

iii) 
IDENTICAL

Part 3: Mechanisms, Substituent Effects, and Reaction Energy Diagrams (20 pts)

3a. Identify each of the following groups as (1) an activator or deactivator and (2) an *o,p*-director or *m*-director (with respect to electrophilic aromatic substitution):

i) 

M-DIRECTING DEACTIVATOR

ii) Cl

O,P-DIRECTING DEACTIVATOR

iii) *t*-Butyl

O,P-DIRECTING ACTIVATOR

7

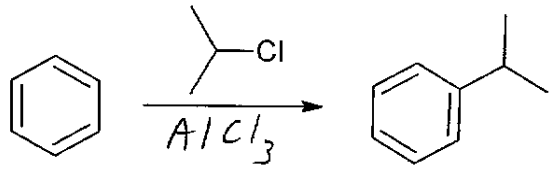
iv) —OCH_3

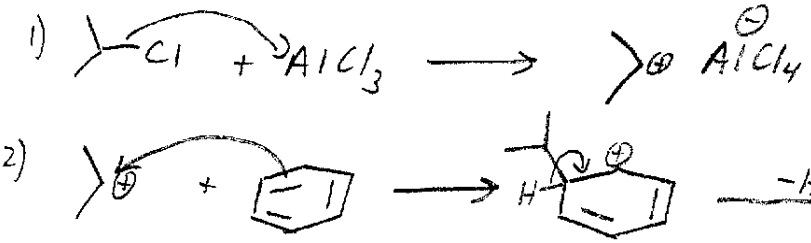
O,P-DIRECTING ACTIVATOR

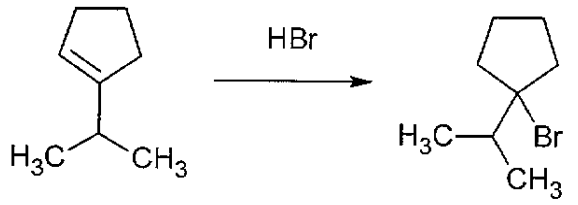
v) —C≡N

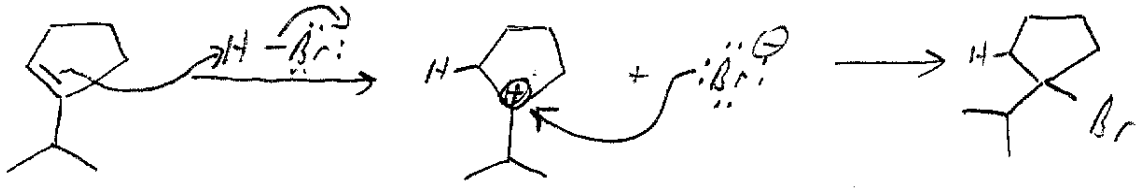
M-DIRECTING DEACTIVATOR

3b. Provide complete arrow pushing mechanisms for the following reactions:

i) 

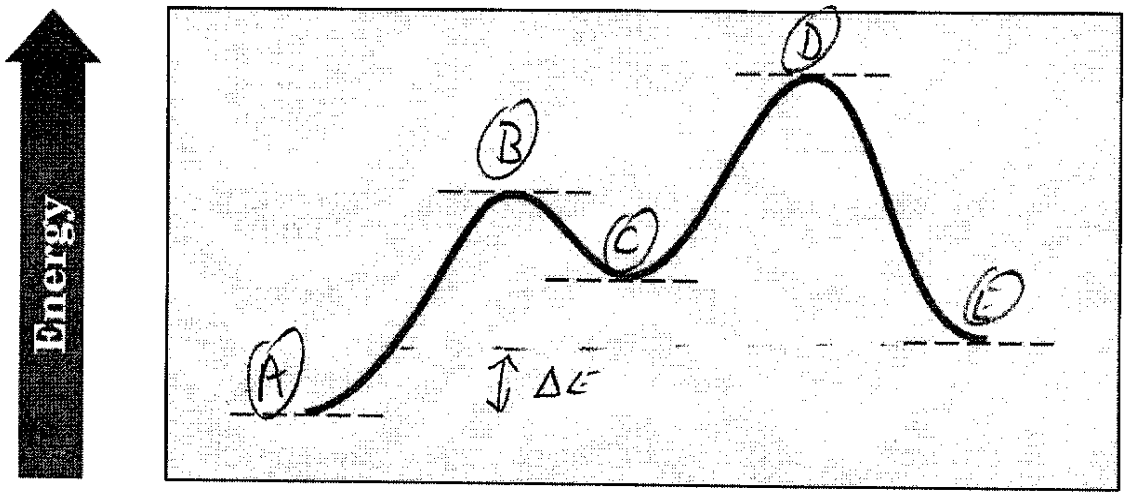


ii) 



3° CARBOCATION
(MORE STABLE THAN
2°)

3c. Answer the following questions regarding the energy diagram below:



i) Label the reactants, product, intermediate(s), and transition state(s) on your energy diagram.

(A) - REACTANTS (C) - INTERMEDIATE (E) - PRODUCT

(B) & (D) - TRANSITION STATES

7

ii) Is the reaction exergonic or endergonic?

ENDERGONIC (ΔE IS POSITIVE)

iii) Which step is rate-limiting?

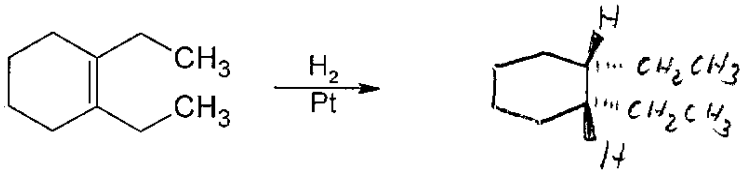
C ⟶ E (2ND STEP)

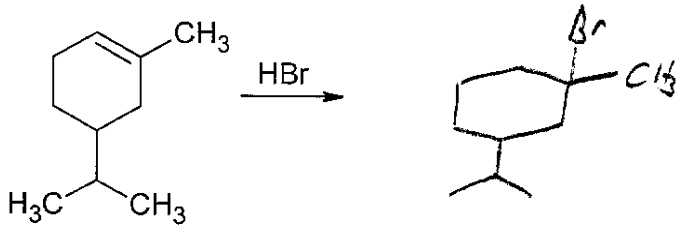
(D IS HIGHEST ENERGY TRANSITION STATE)

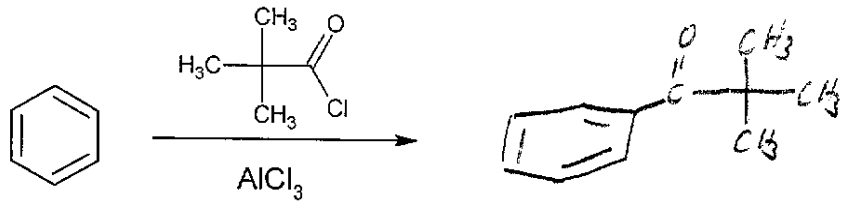
Part 4: Reactions (~~39 pts~~ (33.5)):

4a. Provide the major organic product(s) of the following reactions. Indicate stereochemistry where necessary. If no reaction occurs, write N. R.

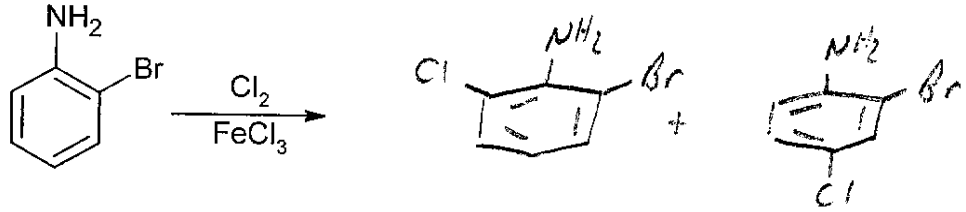
3 pts ea

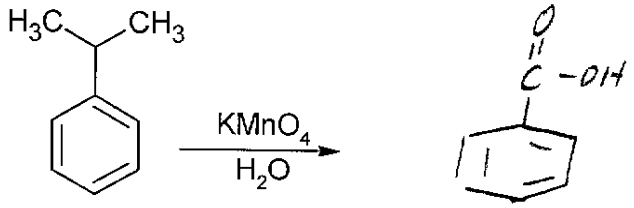
i) 

ii) 

iii) 

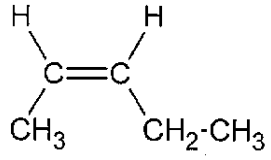
iv) $CH_3\text{-}C{\equiv}CH$ $\xrightarrow[2)\ CH_3CH_2Br]{1)\ NaNH_2}$ $CH_3\text{-}C{\equiv}C\text{-}CH_2CH_3$

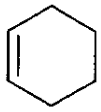
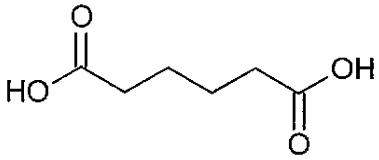
v) 

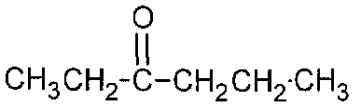
vi) 

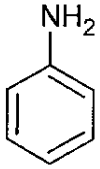
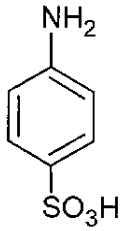
3 pts ea.

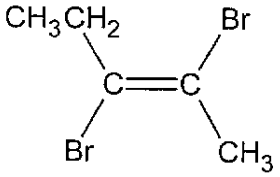
4b. Provide the reagents necessary to accomplish the following transformations:

i) $CH_3\text{-}C{\equiv}C\text{-}CH_2CH_3$ —(H_2, Lindlar catalyst)→ 

ii)  —($KMnO_4$, $H_3O^{\oplus}$)→ 

iii) $CH_3CH_2\text{-}C{\equiv}C\text{-}CH_2\text{-}CH_3$ —(H_2SO_4, $HgSO_4$)→ 

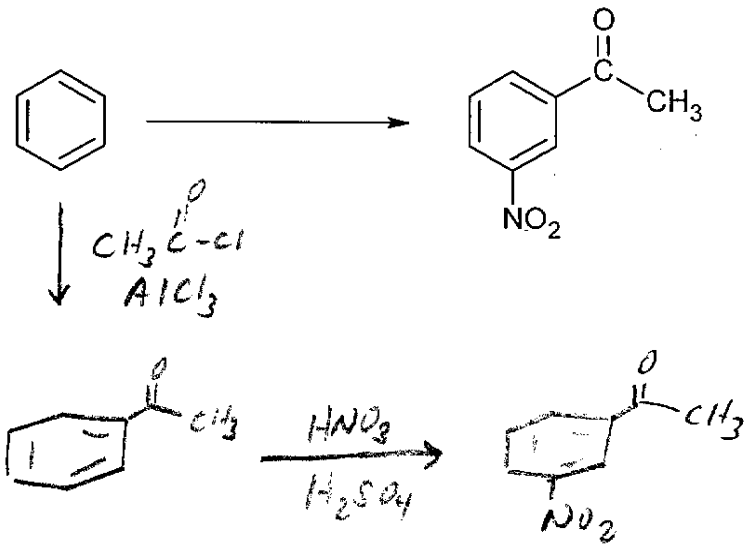
iv)  —(SO_3, H_2SO_4)→ 

v) $CH_3CH_2\text{-}C{\equiv}C\text{-}CH_3$ —(Br_2, (1 equiv.))→ 

Part 5: Synthesis (10 pts)

Show how you would accomplish the following transformations (more than one step will be needed). You may also use any other compounds (e. g. inorganic reagents, alkyl halides, etc.) you need.

5a.



5b.