CHEM 347 – Organic Chemistry II (for Majors)

Instructor: Paul J. Bracher

Quiz #2

Due in Monsanto Hall 103 by:

Friday, February 7th, 2014, 7:00 p.m.

Student Name (Printed)	Solutions
Student Signature	N/A

Instructions & Scoring

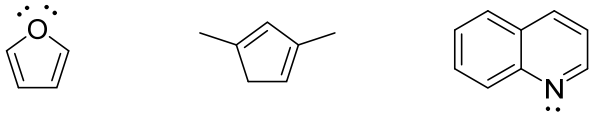
- This quiz must be turned in by the due date listed above.
- You are allowed access to any materials you wish and may discuss the questions with other students.
- Place your answers on the official answer sheet. If you print your own, please print it back-to-back on a single sheet of paper.
- Your quiz may be photocopied.

Problem	Points Earned	Points Available
I		20
II		25
III		20
IV		20
V		15
TOTAL		100

Original Problems, Required Answers, Supplemental Information

Problem I. Multiple choice (20 points total; 5 points for a correct answer, 2 points for an answer intentionally left blank, and 0 points for an incorrect answer.) For each question, select the best answer of the choices given. Write the answer, legibly, in the space provided on the answer sheet.

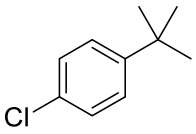
(1) D Which of the following compounds is aromatic?



A **B** **C**

(a) **A** only
(b) **B** only
(c) **B** and **C** only
(d) **A** and **C** only
(e) **A** , **B**, and **C**

(2) C How many signals will appear in the (proton-decoupled) ^{13}C NMR spectrum of compound **D**?



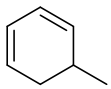
D

(a) four
(b) five
(c) six
(d) seven
(e) eleven

(3) A The molecule 3-bromomethylbenzene is more commonly referred to as:

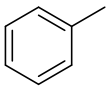
(a) *m*-bromotoluene
(b) *o*-bromotoluene
(c) *m*-methylbromozene
(d) 3-bromoaniline
(e) none of the above

(4) D If the following compounds are ranked in order of lowest (most negative) heat of hydrogenation per double bond to highest (least negative) heat of hydrogenation per double bond, which compound falls in the middle of the list?

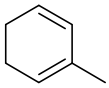


(a)

(b)



(c)

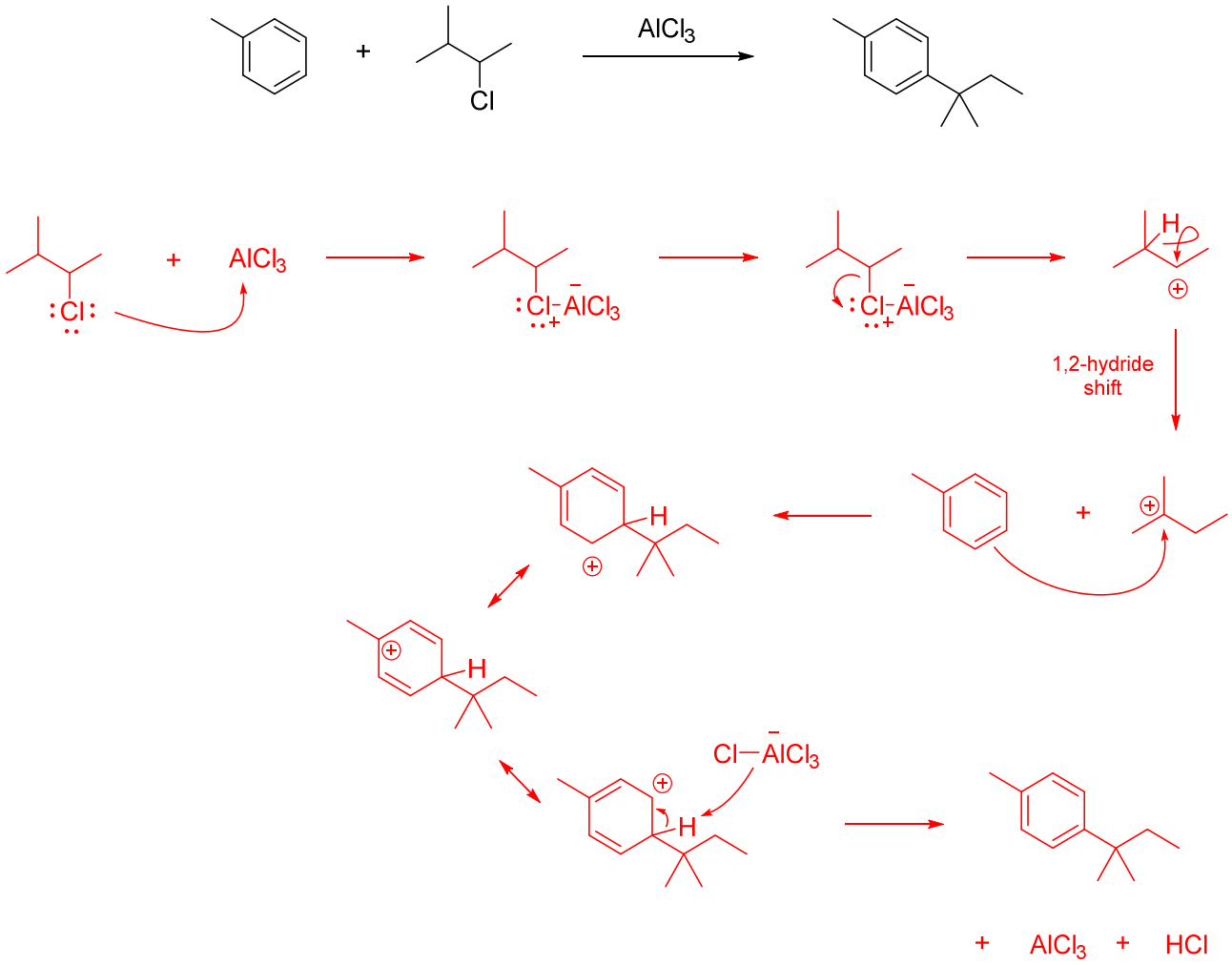


(d)

(e)

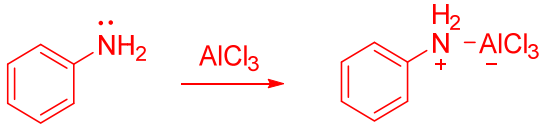
Problem II. Mechanism (25 points).

(a) (20 points) Draw a sensible mechanism for the transformation shown below. Remember to use proper "curved arrow notation" to account for the movement of electrons in the making and breaking of bonds.



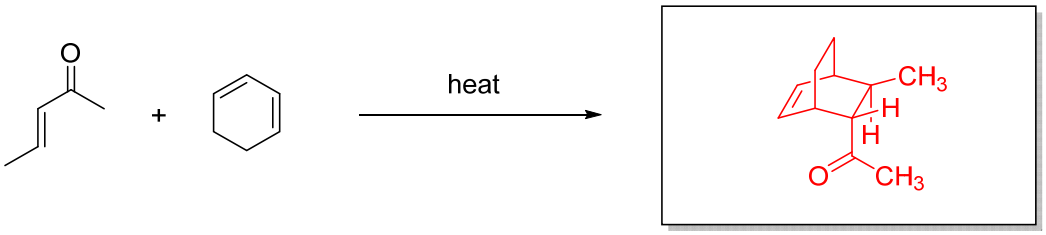
(b) (5 points) Would the analogous alkylation reaction with aniline (aminobenzene) as the starting material instead of toluene proceed faster or slower? Explain why in the space provided (keep your answer very short).

Slower. While amino groups are typically very activating, under Friedel–Crafts conditions, the (Lewis basic) amino group will complex with the aluminum atom to yield a very deactivating ammonium group.

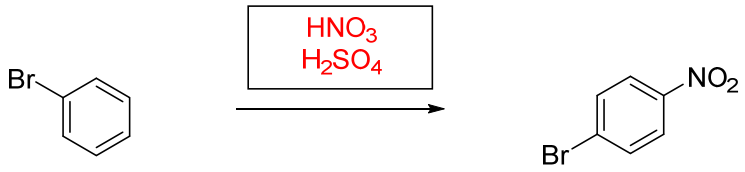


Problem III. Reactions (20 points). The following chemical reactions are missing their starting materials, products, or reagents. Write the missing compounds into the empty boxes below, as appropriate. For missing products, draw the single organic product that you expect to be produced in the highest yield among all of the possibilities. In some cases, there will be more than one correct answer that will merit full credit.

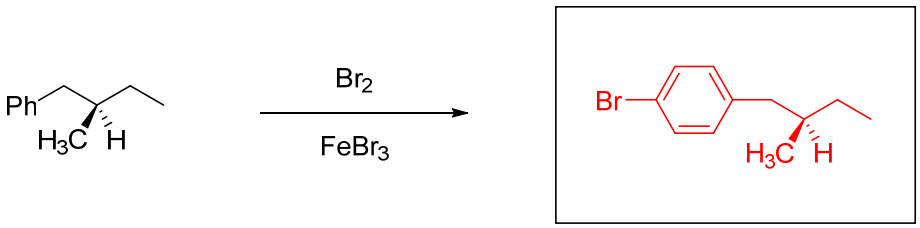
(1) (10 points)



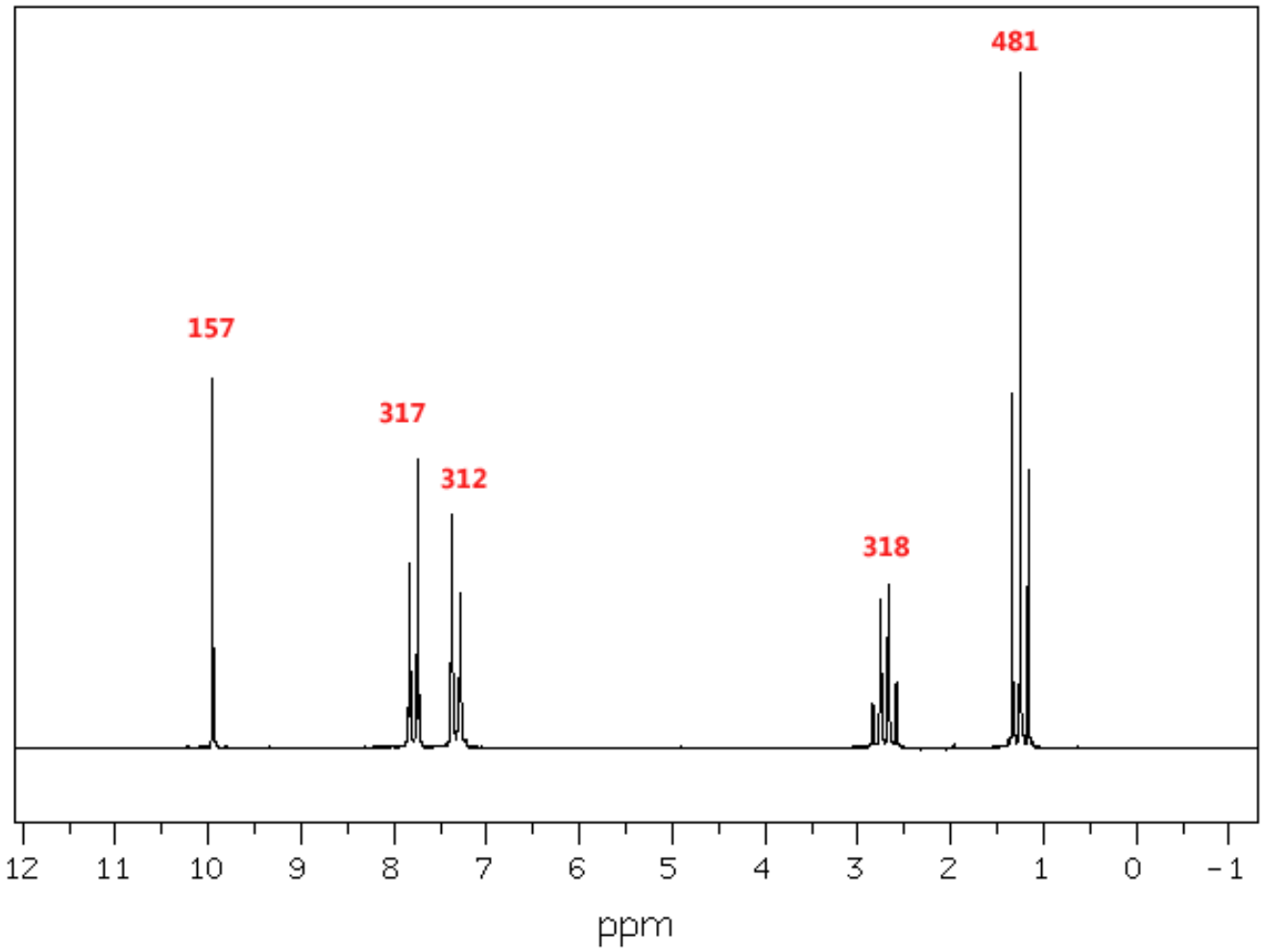
(2) (5 points)



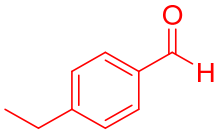
(3) (5 points)



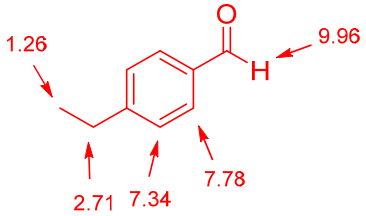
Problem IV. Structure Determination (20 points). High resolution mass spectral analysis of a pure sample of compound **E** reveals it to have a molecular formula of $C_9H_{10}O$. ^1H NMR analysis of a sample dissolved in $CDCl_3$ yields the following spectrum. The numbers in red above each signal represent integration values for the area under each of the signals.



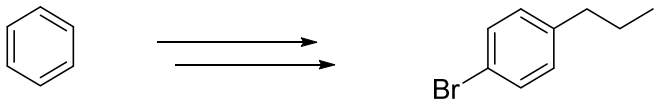
(i) Draw a Lewis structure for compound **E** consistent with the data provided above



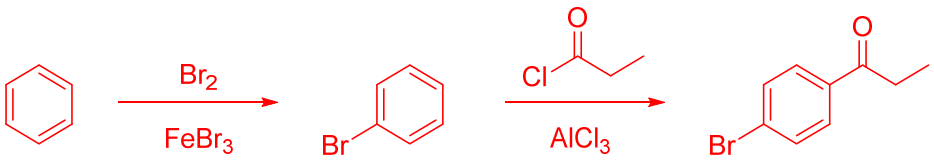
(ii) For each chemical shift, draw an arrow pointing to one of the hydrogens that gives rise to that signal

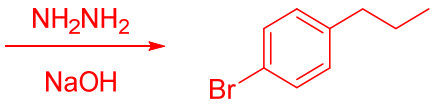


Problem V. Synthesis (15 points). Design an efficient synthesis of compound **F** from benzene and any other reagents you wish that contain five atoms of carbon or fewer. Major hint: Take a look at the Wolff–Kishner reduction at the end of Chapter 18.



F





- Note that Friedel–Crafts acylation is required instead of Friedel–Crafts alkylation because the latter reaction is prone to rearrangements (to add an isopropyl group instead of an n-propyl group) and overalkylation (to add multiple alkyl groups).