CHEM 347 – Organic Chemistry II – Spring 2015

Instructor: Paul Bracher

Hour Examination #1

Wednesday, February 11th, 2015

6:00–8:00 p.m. in Macelwane Hall 334

Student Name (Printed)	
Student Signature	

Instructions & Scoring

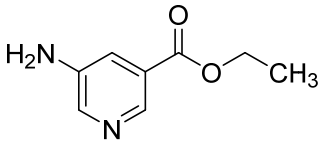
- Please write your answers on the official answer sheet. No answers marked in this booklet will be graded.
- Please write your name on the front *and* back of the answer sheet.
- You may use one letter-sized sheet of hand-written notes and your plastic model kit. No electronic resources are permitted and you may not communicate with others.
- Your exam answer sheet may be photocopied.

Problem	Points Earned	Points Available
I		30
II		18
III		12
IV		20
V		20
TOTAL		100

This exam focuses on Chapters 15, 16, 17, & 18 in Janice Smith's *Organic Chemistry*, 4th ed.

Problem I. Multiple choice (30 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) _____ How many atoms in compound **A** are sp^2-hybridized?

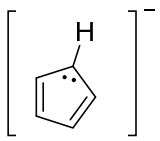


A

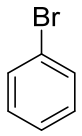
$C_8H_{10}N_2O_2$

(a) 9
(b) 10
(c) 11
(d) 12
(e) all of the atoms in **A** are sp^2-hybridized

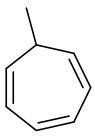
(2) _____ How many of the following compounds are aromatic?



B

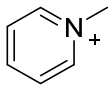


C



D

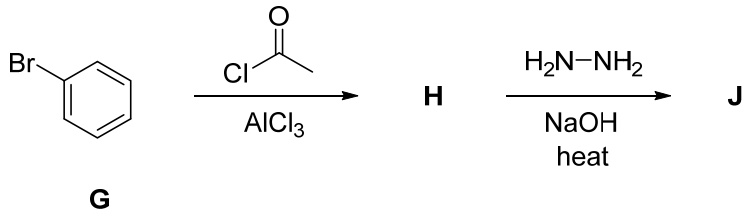
E



F

(a) one
(b) two
(c) three
(d) four
(e) five

(3) _____ What is the name of the major product (**J**) expected of the following sequence of reactions?

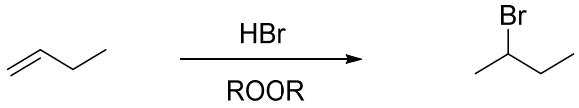


G

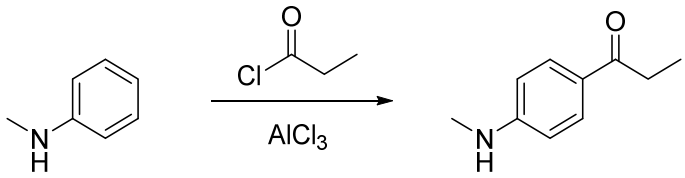
(a) 1-bromo-4-ethylbenzene
(b) *m*-bromotoluene
(c) *p*-bromotoluene
(d) *m*-bromobenzoic acid
(e) *p*-bromobenzoic acid

(4) _____ Which of the following reactions is <u>not</u> flawed and will produce the <u>major</u> product as shown?

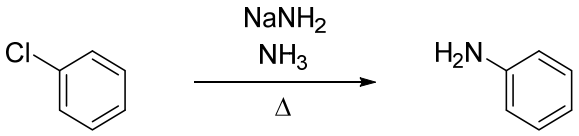
(a)



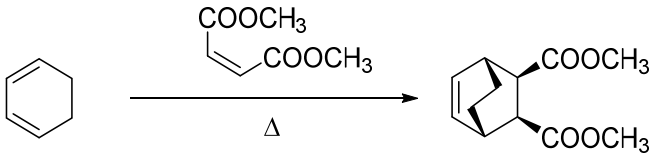
(b)



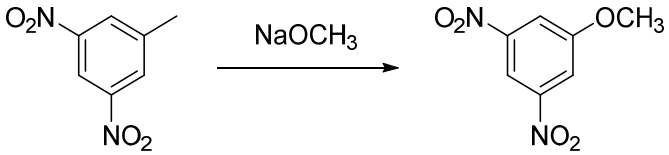
(c)



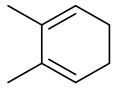
(d)



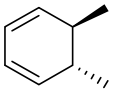
(e)



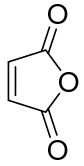
(5) _____ Which of the following statements is <u>not</u> correct?



K



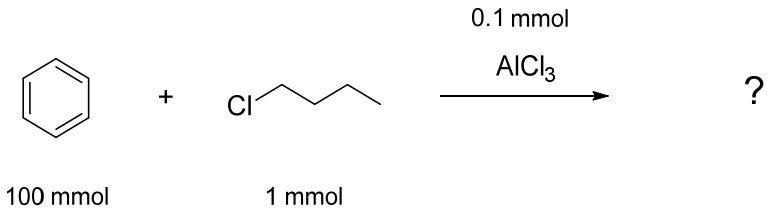
L

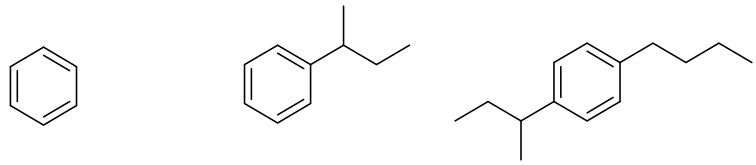


M

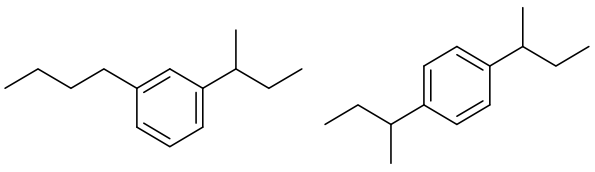
(a) compound **K** is named 2,3-dimethyl-1,3-cyclohexadiene
(b) compound **L** has a less exothermic heat of hydrogenation than **K**
(c) compound **K** will react faster than **L** with compound **M**
(d) compound **K** will react with **M** to form a new six-membered ring
(e) the major product when HBr is added to **K** will vary as a function of temperature

(6) _____ Which of the following compounds would you expect to find in the <u>lowest</u> concentration when excess benzene is treated with 1-chlorobutane and aluminum trichloride?



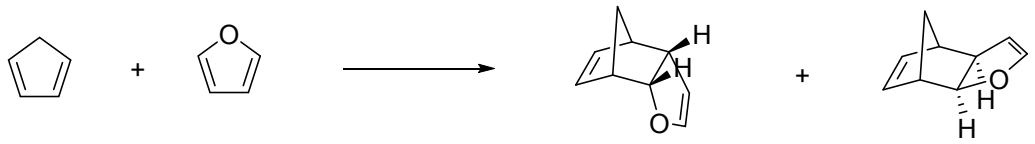


(a) (b) (c)



(d) (e)

Problem II. Explanation (18 points). Cyclopentadiene (**N**) and furan (**P**) react to form diastereomers **Q** and **R** by the Diels–Alder reaction.

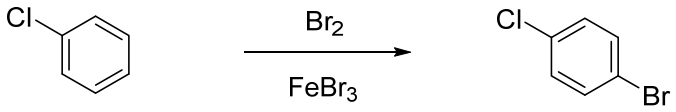


N **P** **Q** **R**

Part (1). (9 points) Explain why product **Q** is favored at lower temperatures and shorter reaction times.

Part (2). (9 points) Explain why product **R** is favored at higher temperatures and longer reaction times. Hint: Do both sides/faces of the double bond look the same?

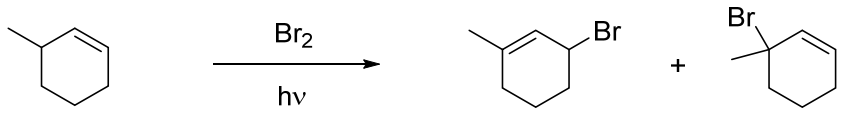
Problem III. Mechanism (12 points). Draw a sensible mechanism for the formation of **T** in the reaction drawn below. Remember to use proper "curved arrow notation" to account for the redistribution of electrons in the making and breaking of bonds. Show all significant resonance forms that account for the stability of the intermediates in the reactions.



S **T**

Problem IV. Mechanism (20 points).

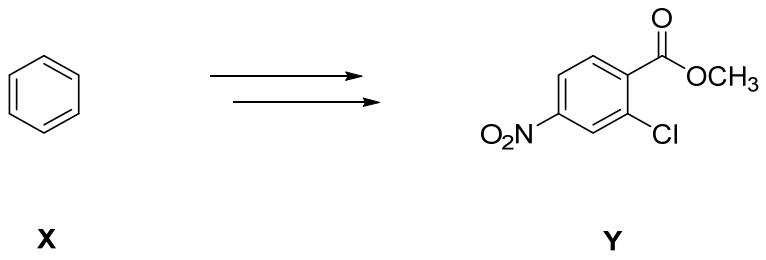
Part (1) (14 points). Draw sensible mechanisms for the formation of **V** and **W** when **U** is irradiated with light in the presence of one equivalent of bromine. Remember to use proper "curved arrow notation" to account for the redistribution of electrons in the making and breaking of bonds. Show all significant resonance forms that account for the stability of the intermediates in the reactions.



U **V** **W**

Part (2) (6 points). Which of these products, **V** or **W**, would you expect to predominate as the major product, especially as the temperature of the reaction is raised? Briefly explain.

Problem V. Synthesis (20 points). Provide a synthetic route—i.e, a sequence of reactions—to produce compound **Y** from benzene (**X**) and any other reagents you need. Hint: Remember from last semester that methyl esters ($RCOOCH_3$) can be made from substitution reactions of methyl halides (e.g., CH_3Br).



X **Y**