Name: _____ **Organic Chemistry Laboratory**

ID #: _____ **Fall 2003**

EXAM #2, Friday, December 12, 2003

Before starting:

Check your exam to make sure that it is complete. Place the initials of your name on each page. The test makes up a total of 8 pages. Problems are on the front of each sheet.

Read each question carefully, making sure that you completely answer each question. You may use the back of a sheet for additional space if needed.

Remember: Questions answered in pencil, red ink, erasable ink, or that have white-out on them cannot be regraded.

Good luck.

Question #	**Possible Points**	**Points Scored**
1	35	_____
2	25	_____
3	38	_____
4	30	_____
5	24	_____
6	48	_____
	Total:	_____

1. Use the list of functional group tests to answer the questions below. Place the letter that corresponds to the functional group test in the space provided (35 pts.).

a. Which test uses a 'silver mirror' to indicate the presence of an aldehyde? _____

b. Which test would give a blue-green solution for a 1^{o} or 2^{o} alcohol? _____

c. Which test allows you to identify aromatic compounds? _____

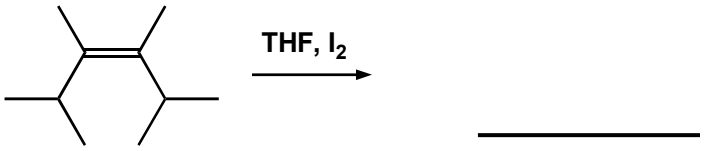
d. Which test allows you to distinguish CH_3NH_2 from $(CH_3)_2NH$? _____

e. Which test allows you to distinguish between Cl, Br, and I? _____

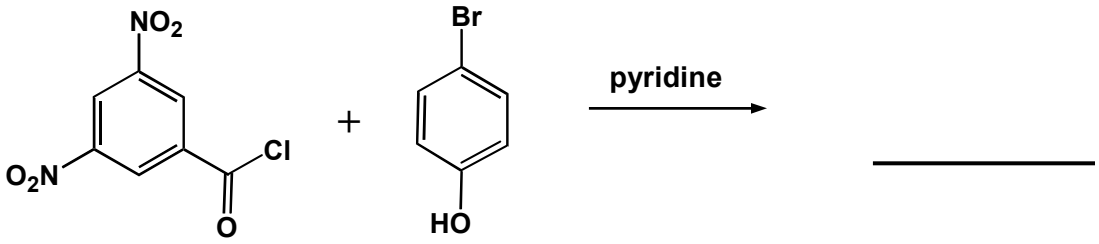
A. Bromine/CCl_4 test
B. Acidity test
C. Tollens test
D. Iron(II) hydroxide test
E. 2,4-Dinitrophenylhydrazine test
F. Hydroxyl amine/ferric chloride test
G. Hinsberg test
H. Basicity test
I. Ferric chloride test
J. Bromine/water test
K. Flame test
L. Lucas test
M. Sodium bicarbonate test
N. Iodoform test
O. Silver nitrate test
P. Chromic acid test
Q. Beilstein test

2. Fill in missing reagents(s) and/or product(s) (or "no reaction") of the following equations in the spaces provided (25 pts.).

a)

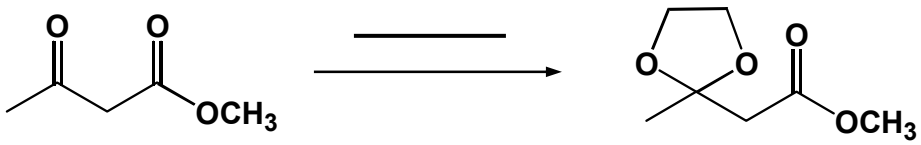


b)



c)

d)



3. Consider the information below and answer the question that follows (38 pts.).

An unknown Compound A (molecular formula: $C_7H_{14}O$) reacts readily in the iodoform test to give a yellow precipitate. Compound A displays a strong absorption in the IR spectrum at 1704 cm^{-1}.

^1H NMR data for Compound A are as follows:

Compound A: 2.8 ppm (singlet, 3H), 2.7 ppm (triplet, 2H), 2.1 ppm (multiplet, 2H), 1.5 ppm (septet, 1H), 0.9 ppm (doublet, 6H)

Propose a structure for Compound A. Explain your answer using <u>all</u> of the information given. For the ^1H NMR spectrum, be sure to label your compound to clearly outline your peak assignments.

4. Multiple choice and short answer (30 pts).

Circle the <u>best answer</u> to each question:

A) The main use of the Dean-Stark trap in the Grignard lab was to:

a) increase the temperature of the reaction
b) maintain a cloudy solution
c) decrease the boiling point of the solvent
d) separate water from the reaction mixture
e) none of the above

B) In the series cyclopentanone, cyclobutanone, and cyclopropanone, the C=O bond of each ring is, according to molecular modeling, expected to _____ upon going from the largest ring size to the smallest ring size.

a) increase in length and exhibit a higher stretching frequency
b) decrease in length and exhibit a lower stretching frequency
c) increase in length and exhibit a lower stretching frequency
d) decrease in length and exhibit a higher stretching frequency
e) exhibit no change in *p*-character

C) True or false? TLC analysis can provide a means to distinguish between *cis* and *trans* isomers of olefins?

a) TRUE b) FALSE

D) The cycloaddition reaction studied in our Green Chemistry lab involved:

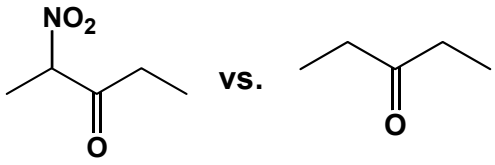
a) a photochemically promoted reaction to produce a three-membered ring
b) a thermally promoted reaction to produce a four-membered ring
c) a photochemically promoted reaction to produce a four-membered ring
d) a thermally promoted reaction to produce a three-membered ring
e) none of the above

E) The only test that may be used to determine whether an ester is present is the:

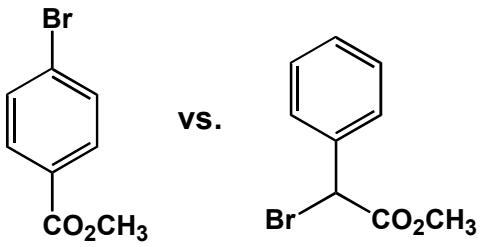
a) Hydroxyl Amine/Ferric Chloride Test
b) Beilstein Test
c) Lucas Test
d) Hinsberg Test
e) none of the above

5. What chemical tests would you use to distinguish between the compounds in each following set of compounds? Explain both your reasoning <u>and</u> your expected observations for <u>each compound</u> of each set (24 pts.).

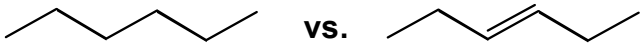
a)



b)

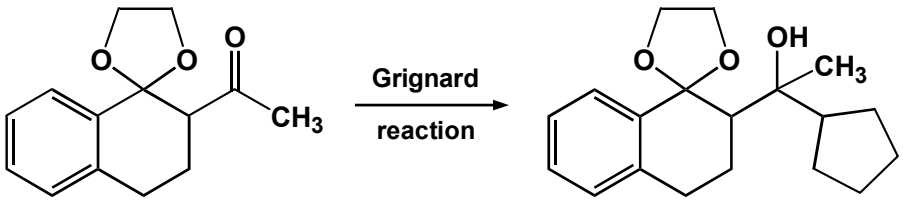


c)



6. Consider the information below and answer the questions that follow (48 pts.).

The commerically available ketal **1** undergoes Grignard reaction in diethyl ether to form the tertiary alcohol **2**. The reaction is quenched using water.



1 **2**

a) Identify the Grignard reagent used in the reaction above.

b) Give a reaction formula that shows how the Grignard reagent would be prepared.

c) A student of organic chemistry attempts to isolate Compound **2** by: i) combining ether extracts of the reaction, ii) washing the extracts with water, and iii) removing the ether solvent using a rotary evaporator. An IR of the solid material obtained after rotary evaporation shows the presence of water. How could the isolation sequence of the student be modified to minimize water contamination? Explain.

d) Why would the presence of large quantities of water make the identification of Compound **2** difficult by IR?

e) What chemical test could the student perform to further elucidate the structure of Compound **2**? Explain.

f) In the presence of aqueous HCl, Compound **2** undergoes reaction to give a mixture of isomers of molecular formula $C_{17}H_{20}O$. Give structures of the two compounds.