

Final Exam

Professor R. Hoenigman

I pledge to uphold the CU Honor Code:

Signature _____

Name (printed) _____

Last four digits of your student ID number _____

Recitation TA _____

Recitation number, day, and time _____

You have 2 hours and 30 minutes to complete this exam.

No model kits or calculators allowed.

Periodic table and scratch paper are attached.

You may use a 3" x 5" notecard.

**** You may "purchase" a structure for a name for 3 points each ****

DO NOT TURN THIS PAGE UNTIL INSTRUCTED TO DO SO.

Recitation Sections:

#	Day	Time	TA
122	Monday	5 pm	Ashley
121	Tuesday	8 am	Noel
131	Tuesday	12 pm	Jin
132	Tuesday	12 pm	Ashley
161	Thursday	8 am	Morin
171	Thursday	12 pm	Jin

SCORE:

Page 1 _____/24 Page 5 _____/70

Page 2 _____/30 Page 6 _____/30

Page 3 _____/30 Page 7 _____/30

Page 4 _____/20 Page 8 _____/16

TOTAL _____/250

1. (6 pts) What is the IUPAC name of $(\text{CH}_3)_2\text{CHOCH}_2\text{CH}_2\text{CH}_2\text{CH}_3$?

- A. butyl isopropyl ether
- B. isobutyl propyl ether
- C. *sec*-butyl isopropyl ether
- D. butyl propyl ether

2. (6 pts) The reaction of excess Grignard reagent with an ester of formic acid gives

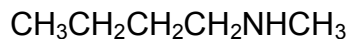
- A. a primary alcohol.
- B. a secondary alcohol.
- C. a tertiary alcohol.
- D. methanol.

3. (6 pts) Rank the following compounds in order of **decreasing** reactivity to aromatic electrophilic bromination.

I. benzene II. toluene III. benzoic acid IV. phenol

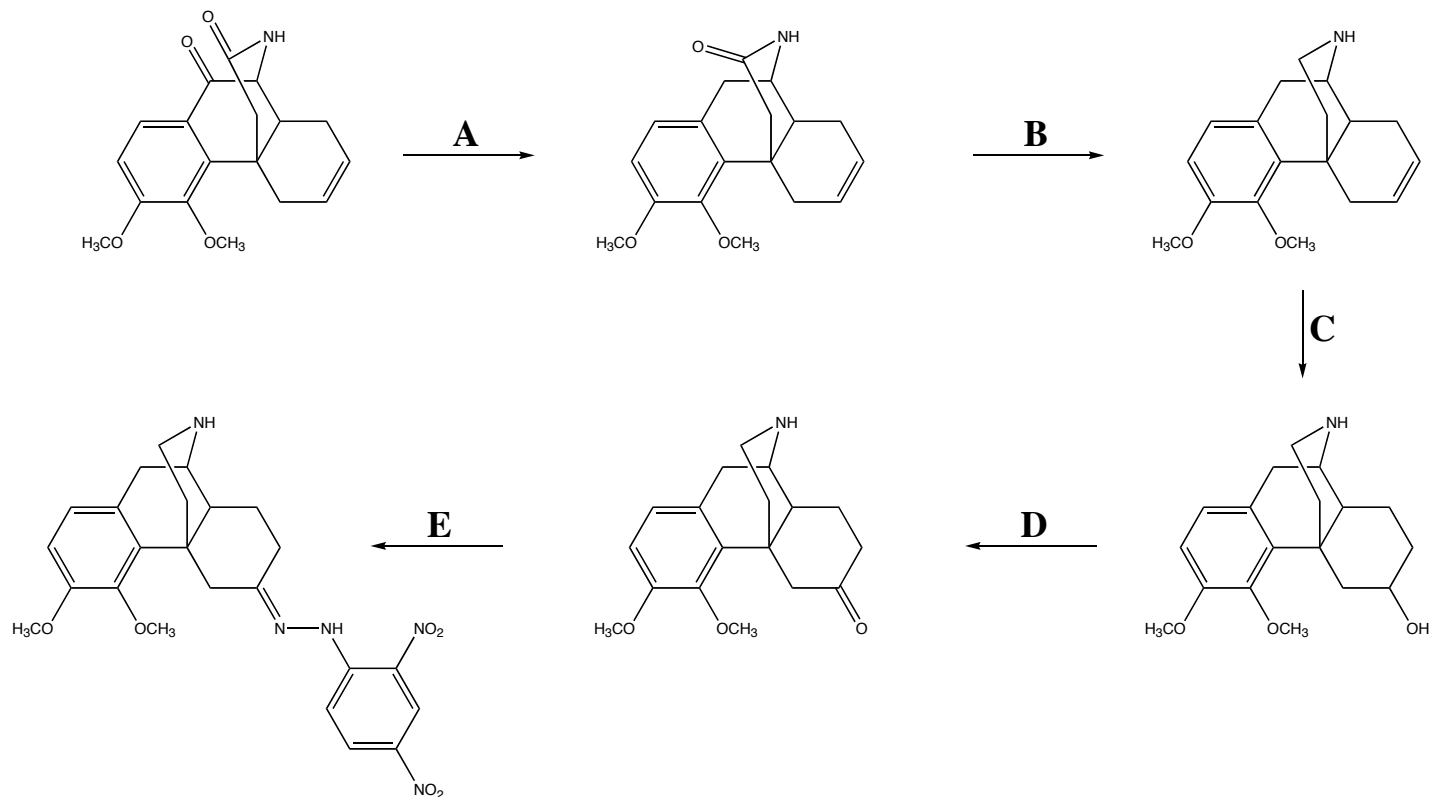
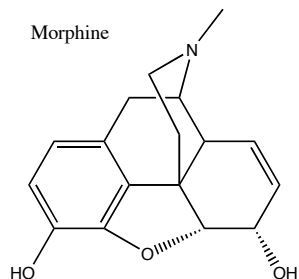
- A. IV > II > I > III
- B. IV > III > II > I
- C. II > I > IV > III
- D. II > III > IV > I

4. (6 pts) What is an acceptable IUPAC name of the following compound?

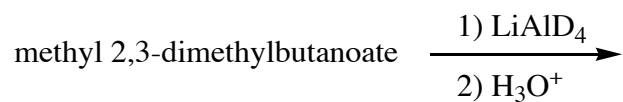


- A. *N*-methylbutylamine
- B. 1-methyl-1-butylamine
- C. *N*-methylaminobutane
- D. 2-pentylamine

5. (30 pts) The schematic outline below consists of intermediate steps in the synthesis of morphine. All of these reactions we have studied this semester. In the boxes below, fill in the missing reagents for each of these transformations.

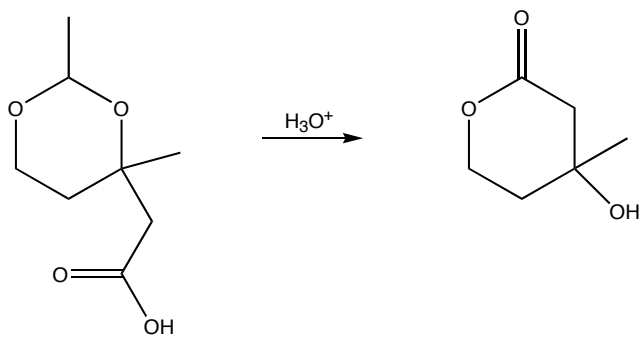


6. (15 pts) Fill in the product of the following reaction and, using arrows to show the flow of electrons, propose a mechanism for the transformation.



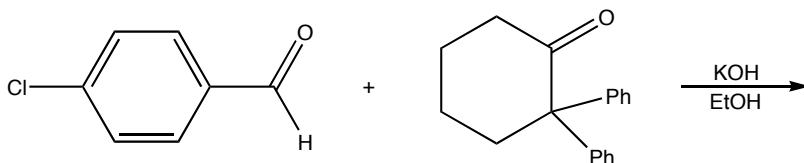
7. (15 pts) Using arrows to show the flow of electrons, propose a mechanism for the chlorination of *para*-hydroxyacetophenone.

8. (20 pts) Using arrows to show the flow of electrons, propose a mechanism for the following transformation.



9. (70 pts) Draw the major organic product(s) of the following reactions. Write NR if no reaction occurs. Be sure to show stereochemistry if necessary.

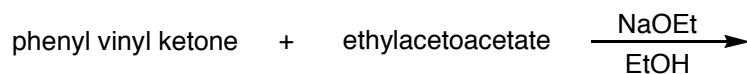
A.



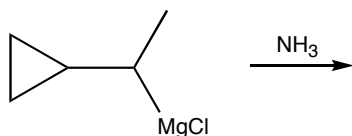
B.



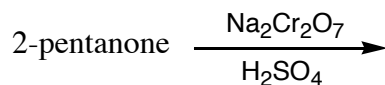
C.



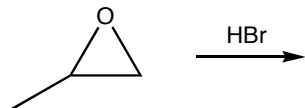
D.



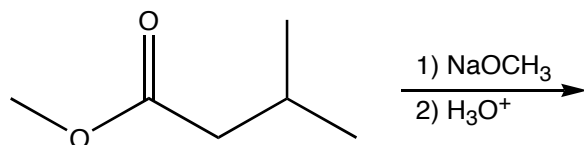
E.



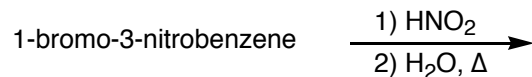
F.



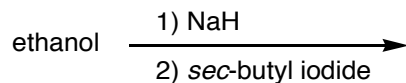
G.



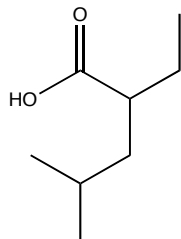
H.



I.



10. (15 pts) Use the malonic ester synthesis to make the compound below. You may use any reagents you like.



11. (15 pts) Propose an efficient synthesis of *ortho*-isopropylaniline starting from benzene. You may use any reagents you like.

12. (15 pts) Propose an efficient synthesis of butylamine starting from propanal. You may use any reagents you like.

13. (15 pts) Propose an efficient synthesis of 3,3-dimethyl-2,4-pentanedione starting from 4-hydroxy-3,3-dimethyl-2-butanone. You may use any reagents you like.

