

Time: 2 Hours.

Chemistry 212

June 28, 1996

Final Examination

H. Sleiman

Name:

Major:

Student Number:

This exam contains 15 pages; no scratch or loose paper; no pencil; BE NEAT.

Question	Grade	Points Possible
I		112
II		27
III		21
IV		30
Total		190

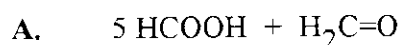
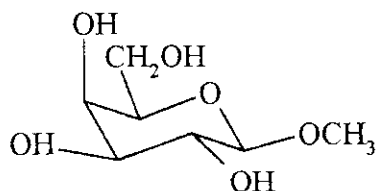
GOOD LUCK !

VERSION I

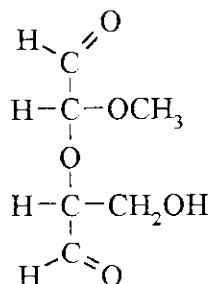
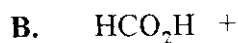
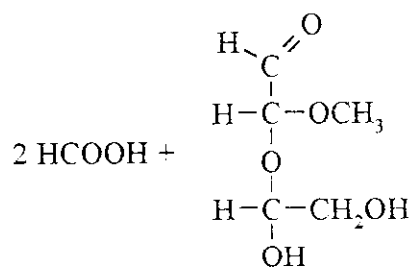
PART I. Choose the best answer of each question and **CIRCLE** the letter of your selection. No penalty will be given for wrong answers.

1. Periodic acid (HIO_4) oxidation of **A** gives:

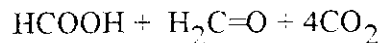
A:



C.

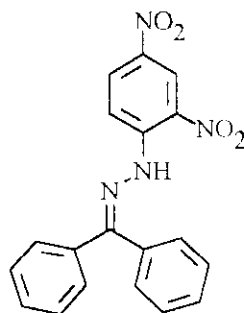


D.



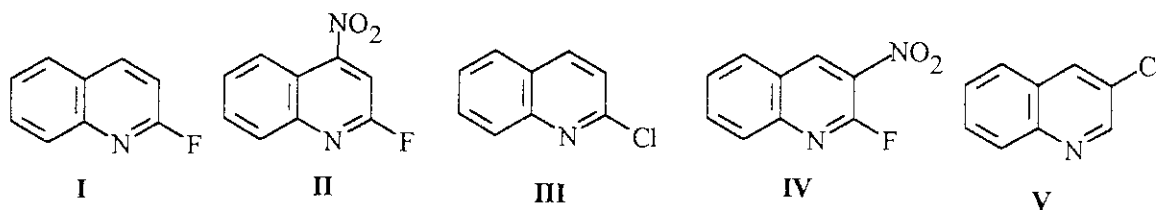
E. No Reaction

2. The name of the following molecule is:



- A. o,p-Dinitrobenzophenone
- B. 2,4-Dinitrobenzaldehyde oxime
- C. Benzophenone 2,4-dinitrophenyl hydrazone
- D. o,p-Dinitroazo-diphenyl ketone
- E. Hydrazine-2,4-dinitro diphenyl ketone

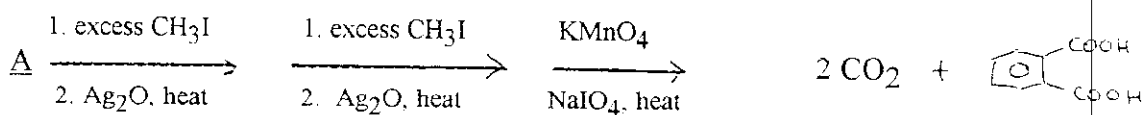
3. Arrange the following molecules in order of increasing rate of nucleophilic addition-elimination.



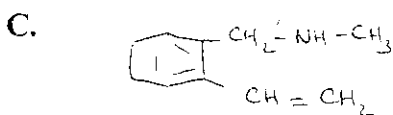
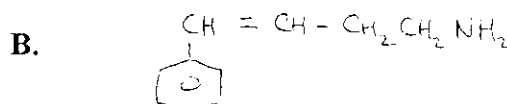
- A. II, IV, V, III, I
 B. I, II, IV, V, III
 C. V, III, I, IV, II
 D. I, V, III, IV, II
 E. V, III, I, II, IV

4. Consider the following:

A ($C_{10}H_{13}N$) [NMR: δ 2.3 (t, 4H); 3.2 (t, 4H); 4.1 (s, 1H); 7.2 (m, 4H)]



The structure of A is:

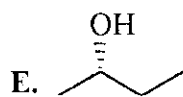
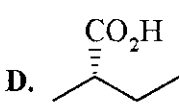
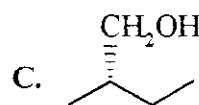
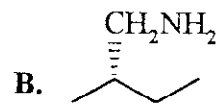
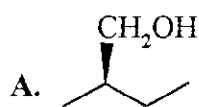
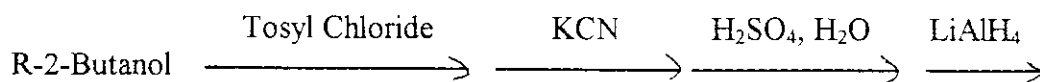


- E. None of the above

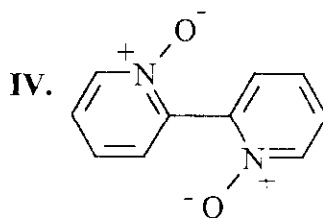
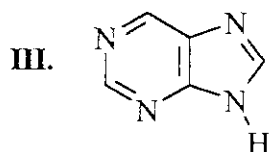
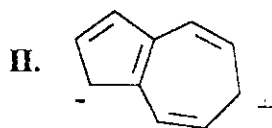
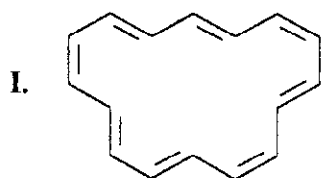
5. The Reformatsky reaction is used in the direct preparation of which of the following?

- A. β -Hydroxyesters B. primary amines
 C. α,β -unsaturated esters D. o-hydroxybenzaldehydes
 E. β -hydroxyketones

6. Select the correct final product of the following reaction sequence:

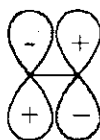


7. Which of the following molecules can be considered aromatic?



- A. III only
 B. I and III
 C. III and IV
 D. II, III and IV
 E. I, II and III

8. Which of the following best describes the diagram below of a molecular orbital?

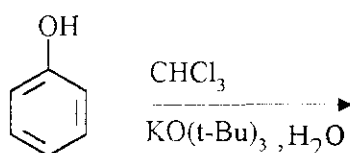


- A. A non bonding orbital
 B. A bonding σ orbital
 C. An antibonding π orbital
 D. An antibonding σ orbital
 E. A bonding π orbital

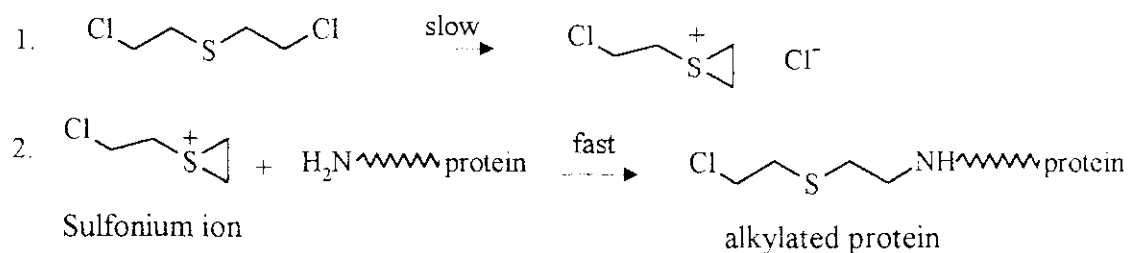
9. What are the missing reagents in the following equation, in the order of their addition?



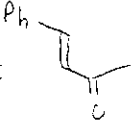
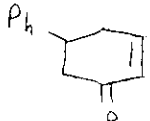
- A. KCN, H₂SO₄, P/Br₂, KCN, H₂SO₄, NaBH₄, CH₂=PPh₃
 B. KCN, H₂SO₄, P/Br₂, C₂H₅OH/H⁺, Zn/CH₃-C(O)H, H₂SO₄/heat
 C. Mg, CO₂, P/Br₂, Mg, CH₃-C(O)H, H₂SO₄/heat
 D. Li(CH=CH₂), Br₂/hν, KCN, H₂SO₄
 E. None of the above
10. The major product of the following reaction is:



- A. Resorcinol
 B. Picric Acid
 C. p-Hydroxybenzoic acid
 D. Salicylic acid
 E. o-Hydroxybenzaldehyde
11. Mustard gas, ClCH₂CH₂SCH₂CH₂Cl, a known chemical weapon, is known to cause damage in the human body by alkylating proteins. The following is the mechanism of its action. Which rate law for this reaction is true?



- A. rate = k [mustard gas][protein] B. rate = k [mustard gas]
 C. rate = k [sulfonium ion][protein] D. rate = k [sulfonium ion]
 E. None of the above

12. To convert  to , a certain sequence of steps is required.

These steps are listed below. Arrange them in the appropriate order and then choose the proper response. [note: each step may be used once, more than once, or not at all].

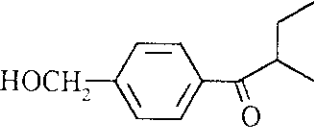
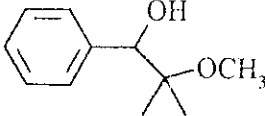
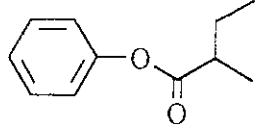
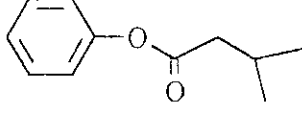
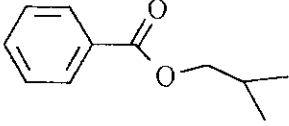
- | | | |
|---|--|-------------------------------|
| 1. $\text{H}_2\text{SO}_4, \text{HgSO}_4, \text{H}_2\text{O}$ | 5. $\text{CH}_3\text{-C(O)H}, \text{NaOH}$ | 9. NaOH, heat |
| 2. $\text{Br}_2, \text{h}\nu$ | 6. H_2O | 10. HCl, heat |
| 3. $\text{CH}_3\text{CH}_2\text{MgBr}$ | 7. $\text{H-C}\equiv\text{C-H}, \text{Na}$ | |
| 4. $\text{CH}_3\text{O-C(=O)-CH}_2\text{-C(=O)-H}, \text{CH}_3\text{ONa}$ | 8. $\text{CH}_3\text{O-C(=O)-CH}_2\text{-C(=O)-OCH}_3$ | |

- A. 5, 9
 B. 8, 10, 9
 C. 3, 6, 2, 9
 D. 7, 6, 1, 9
 E. 4, 10, 9

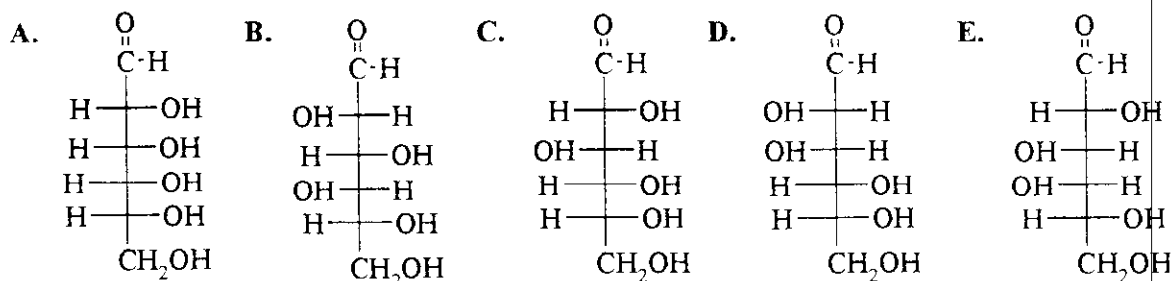
13. Which of the following would not react with ethylmagnesium bromide?

- | | |
|---|--|
| A. $\text{CH}_2=\text{CH-CH}_2\text{Cl}$ | B. $\text{H}_2\text{C=O}$ |
| C. $\text{CH}_2\text{-CH}_2$, ethylene oxide | D. $\text{CH}_3\text{CH}_2\text{-O-CH}_2\text{CH}_3$ |
| E. H-C=C-H | |

14. A compound $\text{C}_{11}\text{H}_{14}\text{O}_2$ possesses an intense IR band at 1720 cm^{-1} , and the following NMR data; deduce its structure.
 δ 1.0 (doublet, 6H); 2.1 (multiplet, 1H); 4.1 (doublet, 2H); 7.8 (multiplet, 5H)

- | | |
|--|---|
| A.  | D.  |
| B.  | E.  |
| C.  | |

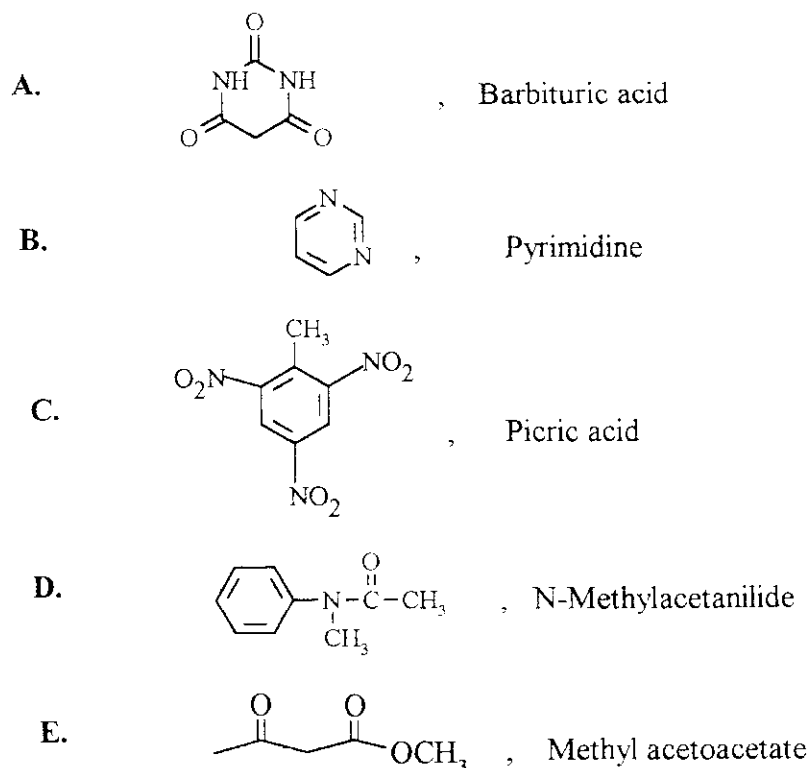
15. An aldohexose **A** is reduced by sodium borohydride to an optically inactive alditol **B**. Ruff degradation of **A** gives an aldopentose **C**, which is oxidized by nitric acid to an optically active aldaric acid, **D**. What is the structure of **A**?



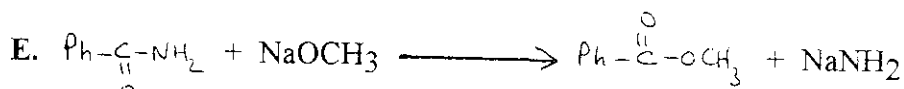
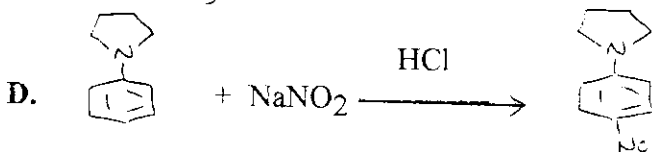
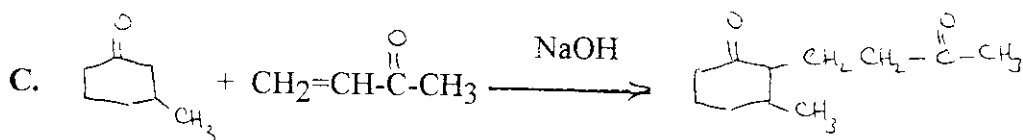
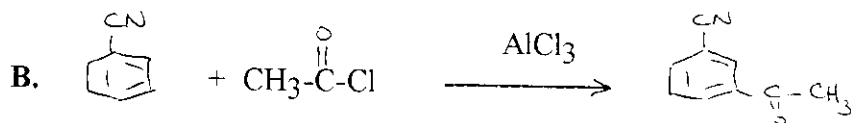
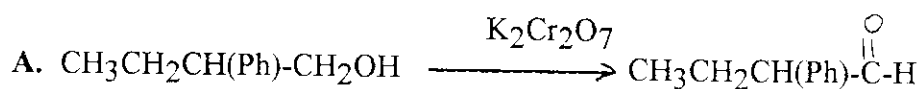
16. Which of the following may be deduced from the ultraviolet spectrum of a molecule?

- A. The presence of conjugated double bonds
 B. The presence of halides
 C. The structure of crystals
 D. The rotational energy states of a molecule
 E. The vibrational energy states of a molecule

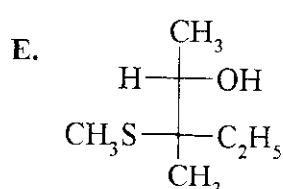
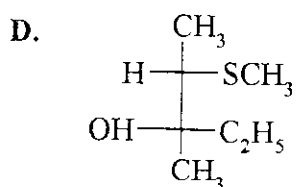
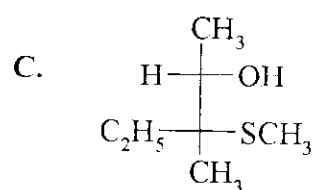
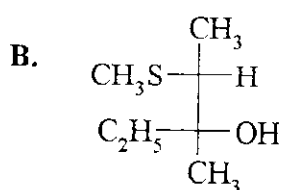
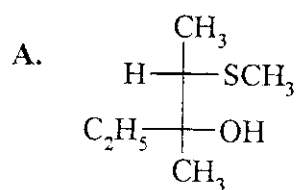
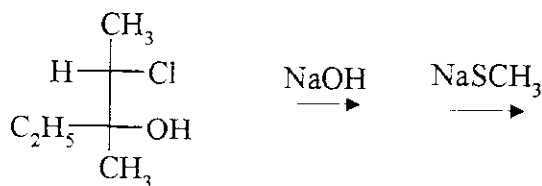
17. Which of the following compounds is misnamed?



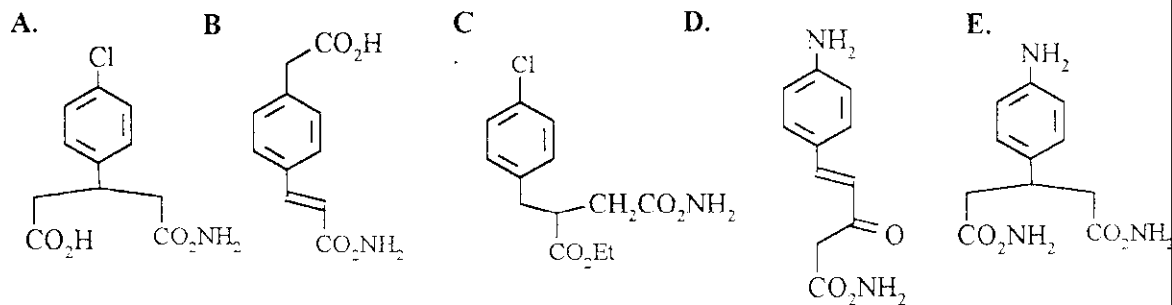
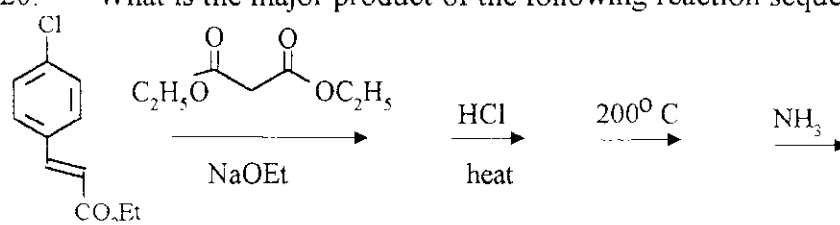
18. One of the following reactions gives the indicated product with a reasonable yield (i.e. as the major product). Indicate which.



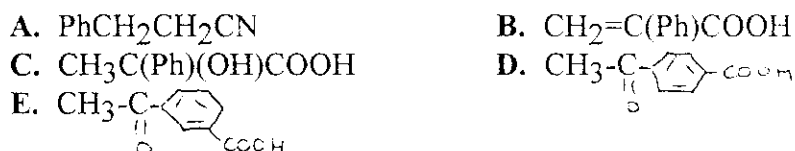
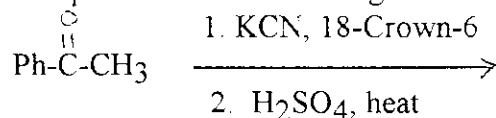
19. What is the product of the following reaction sequence?



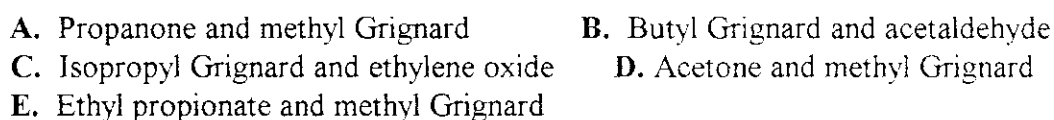
20. What is the major product of the following reaction sequence?



21. The product of the following reaction is:




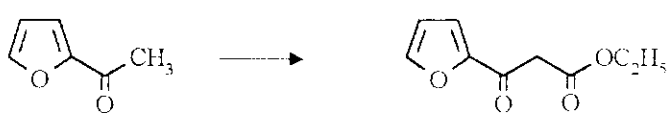
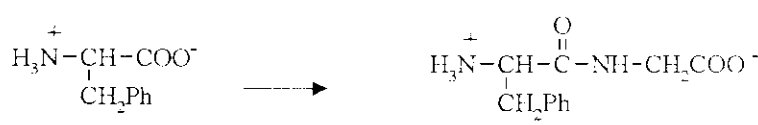
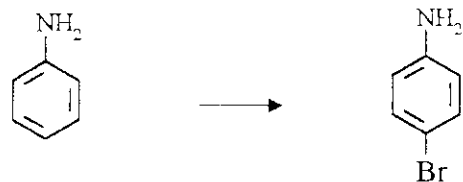
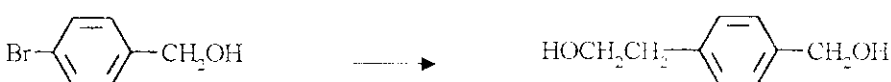
22. Which of the following Grignard reactions could give CH₃CH₂C(OH)(CH₃)₂?



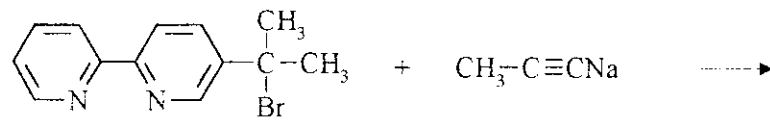
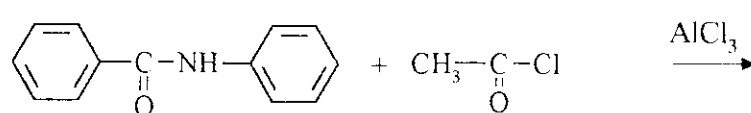
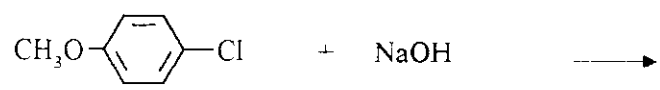
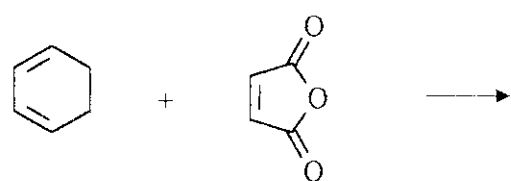
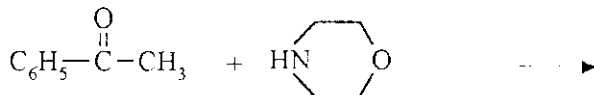
23. Circle the incorrect statement:

- A. The Williamson synthesis is a reaction used to make ethers.
 B. The Tollen's reaction is used to make carboxylic acids from aldehydes.
 C. The Cannizzaro reaction is used to make carboxylic acids and alcohols from aldehydes.
 D. The haloform reaction is used to make α-haloacids.
 E. The Reimer-Tiemann reaction is used to make o-hydroxybenzaldehydes.

24. Which of the following transformations does not require the use of a protecting group?

- A. 
- B. 
- C. 
- D. 
- E. 

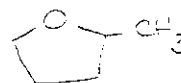
25. Which of the following reactions does not proceed under normal conditions?

- A. 
- B. 
- C. 
- D. 
- E. 

26. Which reagent reacts with propanal to yield a semicarbazone?

- A. $\text{H}_2\text{N}-\text{NH}-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}_2$ B. NH_2NH_2
C. PhNHNH_2 D. NH_2OH
E. $\text{H}_2\text{N}-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}_2$

27. The name of the following compound is:



- A. 2-Methyltetrahydrofuran B. Oxacyclohexane
C. Cyclopentyl methyl ether D. 2-Methyl epoxide
E. Oxacyclopentane

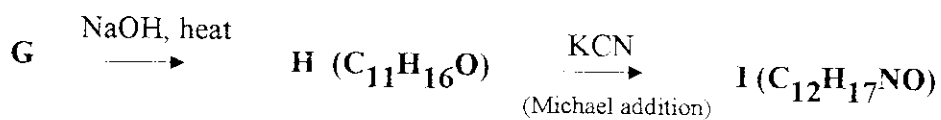
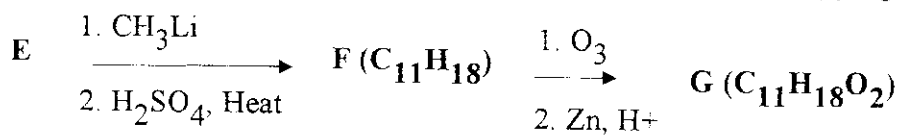
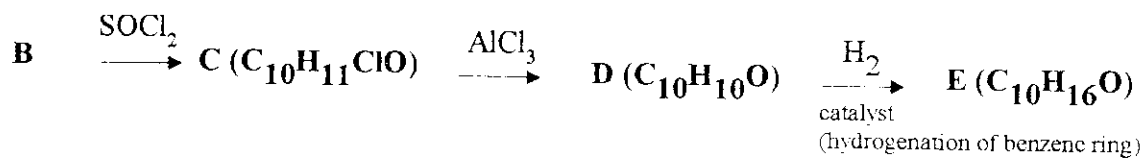
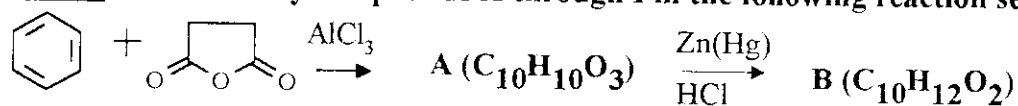
28. Bradykinin is a nonapeptide released by blood plasma globulins in response to a wasp sting. Its molecular formula is $\text{Arg}_2, \text{Gly}, \text{Phe}_2, \text{Pro}_3, \text{Ser}$. Partial acid hydrolysis of bradykinin gives the following peptides:



The amino acid sequence of bradykinin is:

- A. $\text{Phe-Ser-Pro-Phe-Arg-Pro-Pro-Gly-Phe-Arg}$
B. $\text{Phe-Ser-Pro-Pro-Gly-Phe-Arg-Pro}$
C. $\text{Arg-Pro-Pro-Gly-Phe-Ser-Pro-Phe-Arg}$
D. $\text{Phe-Arg-Pro-Pro-Gly-Phe-Ser-Pro-Phe-Arg}$
E. $\text{Arg-Pro-Gly-Phe-Ser-Pro-Pro-Phe-Arg}$

Part II. Identify compounds A through I in the following reaction sequence:



A

B

C

D

E

F

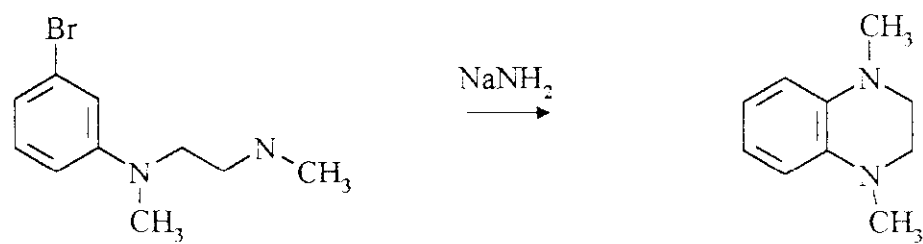
G

H

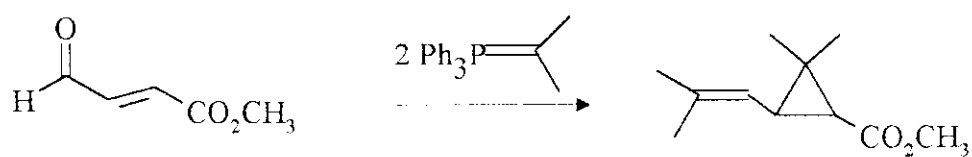
I

Part II. Provide mechanisms for the following transformations

1.



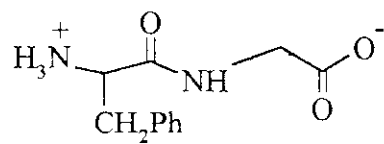
2.



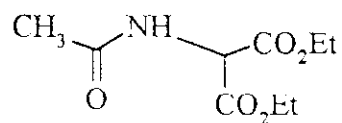
Part III.

Provide a synthesis for the following from the indicated starting materials and any needed organic and/or inorganic reagents.

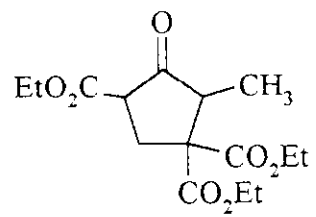
1.



from



2.



from

