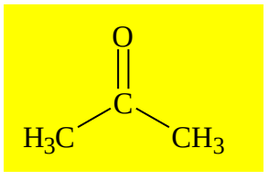
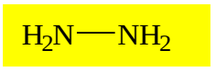
Organic Chemistry II
CHM 2211
Sample Exam 2 Answer Key

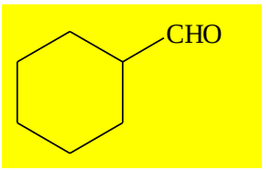
I. Write Structures for the compounds named below: (12 points)



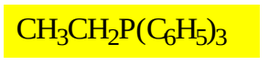
Acetone



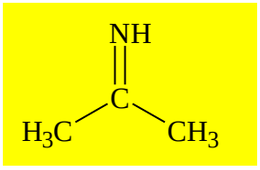
Hydrazine



Cyclohexane carbaldehyde



An ethyl ylide of triphenylphosphine



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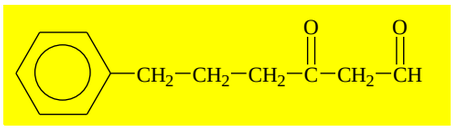
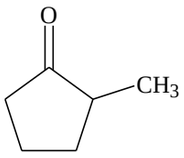
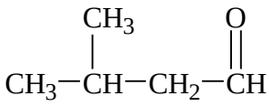


3-Oxo-6-phenylhexanal

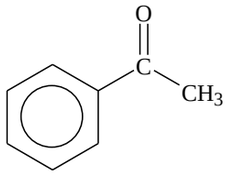
II. Name the compounds whose structure is shown below: (6 points)



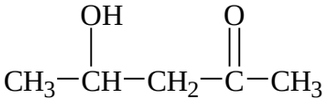
2-methylcyclopentanone



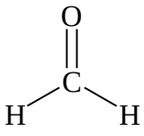
3-methylbutanal



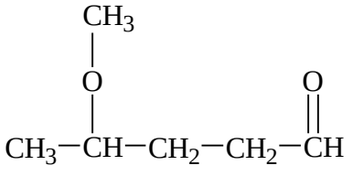
acetophenone



4-hydroxy-2-pentanone



formaldehyde (methanal)



4-methoxypentanal

III. Fill in the Blanks (13 points)

1. Why does the carbonyl carbon have a partial positive charge? Because of the electron withdrawing nature of the oxygen

2. When an aldehyde is considered as a group, it is called carbaldehyde group. When a ketone cannot be named as an -one, it is named as an oxo- group.

3. An oxidizing agent that can oxidize an alcohol to an aldehyde without going all the way to an acid is (write the whole name) pyridinium chlorochromate (PCC).

4. CrO_3 in H_2SO_4 is called Jones' Reagent while R_2LiCu is called Gilman's reagent.

5. A positive Tollen's test for aldehydes is indicated by the formation of a silver mirror on the test tube.

6. Two important types of diols are *geminal* and *vicinal*. Which is the least stable? Geminal diols are unstable.

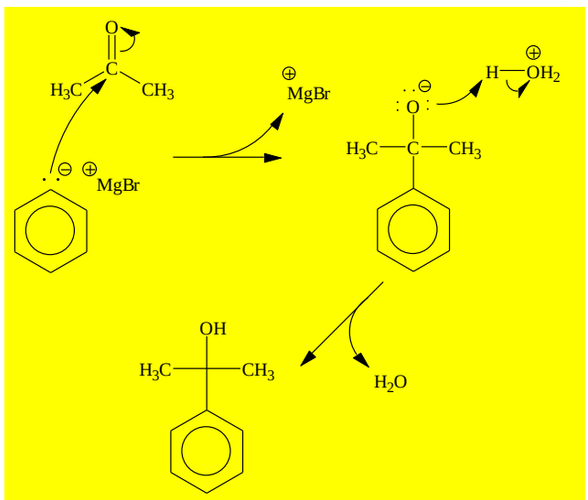
7. The Clemmenson reduction will reduce a(n) ketone or aldehyde to a(n) alkane (-CH_2).

8. Which would be easier to identify using IR spectroscopy, an ether or a ketone? ketone

9. Alcohols are capable of hydrogen bonding with water but aldehydes are not. (T/F) False

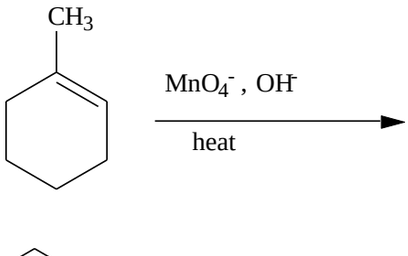
10. Which would be easier to oxidize with Jones' Reagent, a ketone or an aldehyde? aldehyde

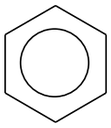
IV. Write a multi step reaction mechanism for the reaction of phenylmagnesium bromide (ΦMgBr) with acetone to form an alcohol. Indicate intermediates that may or may not be isolated. Use curved arrows to indicate electron attack and show charges and intermediates. (9 points)

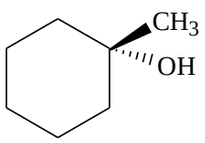


V. Complete the following reaction equations by filling in the missing information: (40 points)

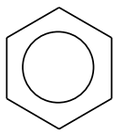
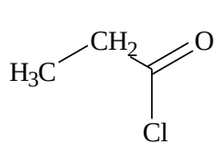
1. CH_3CH_2OH → (HCN, CN^-) → (H_2SO_4, H_2O, heat) → ($SOCl_2$) → $CH_3\text{-}CH_2\text{-}C(Cl)=O$

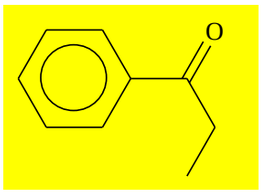
2. 

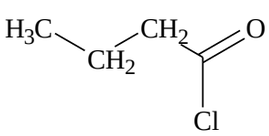
3.  + t-But-Br → ($AlBr_3$) → tert-butylbenzene → (MnO_4^-, OH^-, Δ) → No Reaction (no benzylic H)

4. 

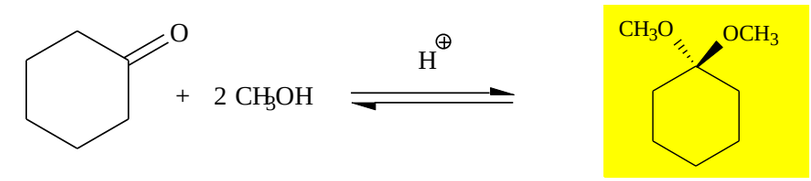
→ ($Na_2Cr_2O_7$, H^+ / H_2O) → No Reaction (tertiary alcohol)

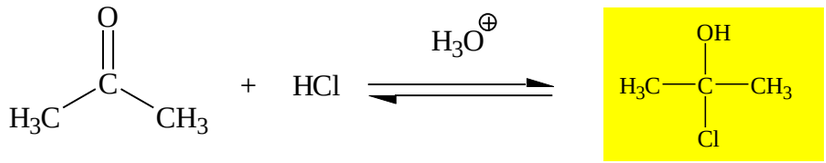
5.  + 

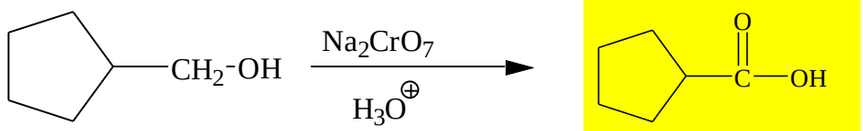
→ ($AlCl_3$) → 

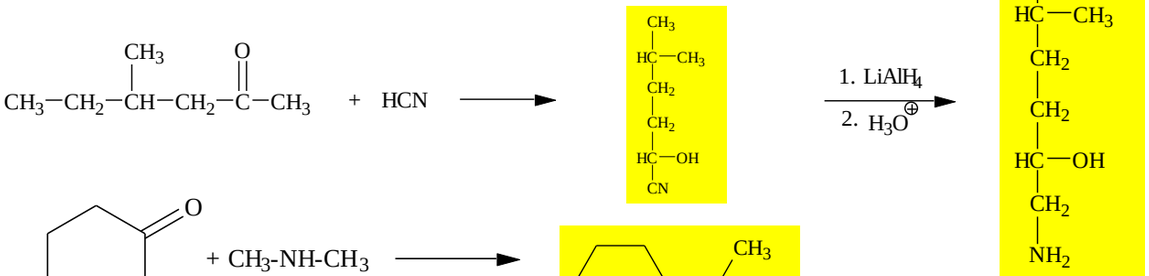
6. 

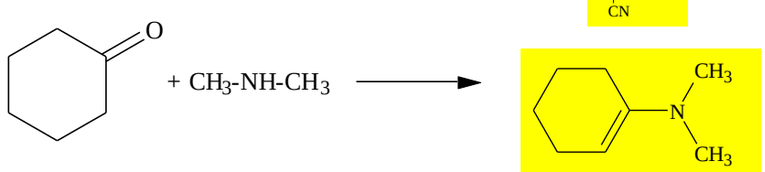
→ ($LiAlH(OtBu)_3$) → $CH_3\text{-}CH_2\text{-}CH_2\text{-}CH{=}O$

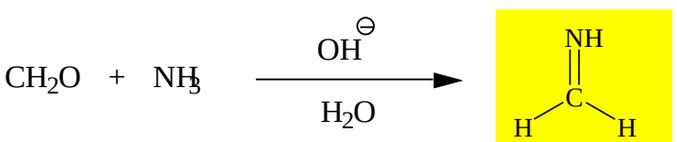
7. 

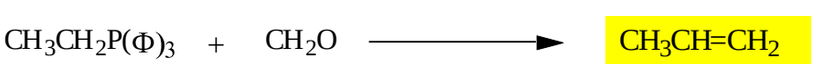
8. 

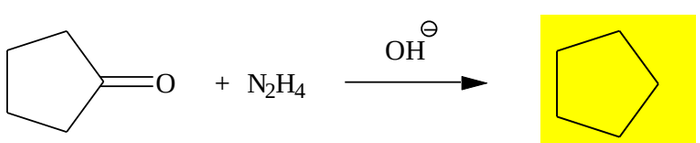
9. 

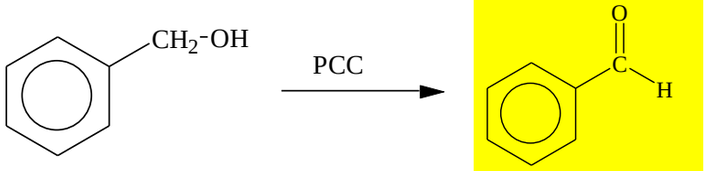
10. 

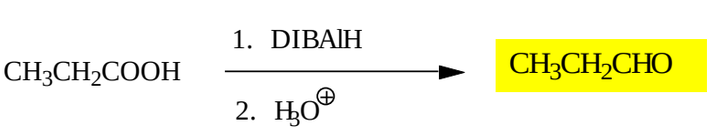
11. 

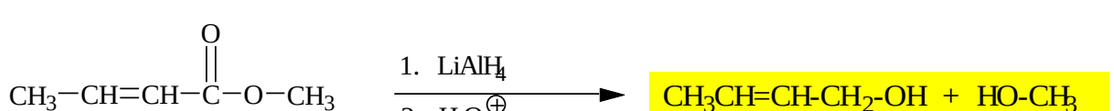
12. 

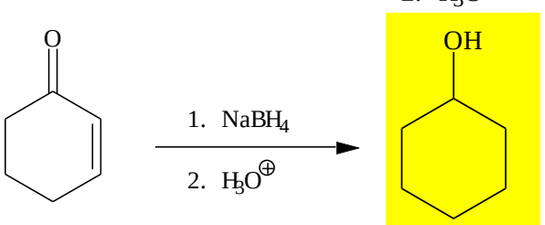
13. 

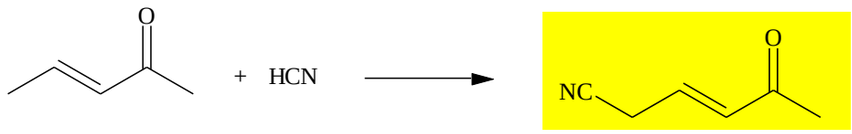
14. 

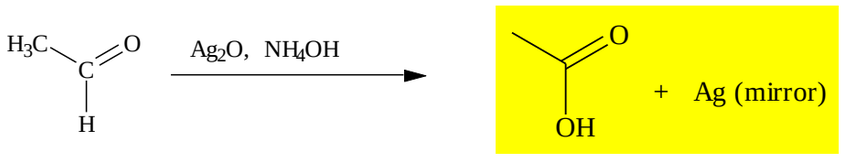
15. 

16. 

17. 

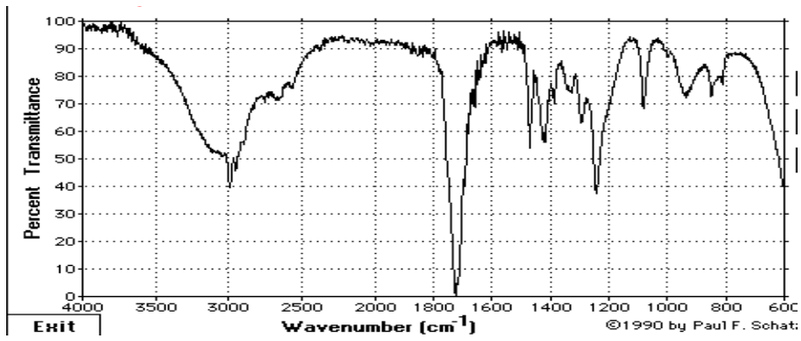
18. 

19. 

20. 

VI. Multiple Choice (Circle the letter of the best answer) (20 points)

1. Below might be the spectrum of a carboxylic acid. Which two features make this likely?



a. The broad peak above 3000 cm^{-1} and the sharp peak at 1710 cm^{-1}
b. The peaks at 1240 and 1090 cm^{-1}
c. The sharp peak at 3000 cm^{-1} and the sharp peak at 1240 cm^{-1}
d. This is probably not the spectrum of a carboxylic acid.

2. Which compound will reduce C=O but not C=C (at least not much)?

a. Jones' Reagent
b. PCC
c. $LiAlH_4$
d. $NaBH_4$
e. Chromic Acid

3. Which of these is not an oxidizing agent?

a. PCC
b. DIBAH
c. $Na_2Cr_2O_7$ in H_2SO_4
d. Jones' Reagent
e. Hypochlorite

4. Alkoxymercuration followed by borohydride reduction would be used to produce

a. an alcohol from an alkene.
b. an aldehyde from alcohol.
c. an acid from and alkyne.
d. an ether from an alkene.
e. an alkene from an aryl halide.

5. Which of the following is not a common reaction of aldehydes?

   a. Nucleophilic acyl addition
   b. Nucleophilic acyl substitution
   c. alpha Substitution
   d. Carbonyl condensation
   e. Reduction to a ketone

6. When CN^{-1} is reacted with carbonyl compounds followed by protonation of the oxygen, what do we call the products?

   a. Cyanohydrins
   b. Nitriles
   c. Ketones
   d. Imines
   e. Enamines

7. In proton NMR, which compound or groups will show a characteristic peak near 10 ppm?

   a. Alcohols
   b. Aldehydes
   c. Ketones
   d. C=O
   e. Methyl on a carbonyl

8. 2,4 DNP derivatives of carbonyl compounds are often made to

   a. make the compound soluble.
   b. oxidize the compound.
   c. confirm the identity of a compound by the MP of the derivative.
   d. make the compound colored.
   e. produce a Grignard reagent for further reaction.

9. How would you easily tell the difference between a proton NMR (^{1}HNMR) and a carbon (^{13}CNMR) spectrum?

   a. by looking at the size of the peaks
   b. by looking at the location of the peaks
   c. by looking at the horizontal scale
   d. by looking at peak splitting
   e. by looking for the internal standard peak

10. Hemiacetals and acetals are often found in

   a. carbohydrates.
   b. proteins.
   c. fats.
   d. oils.
   e. DNA.