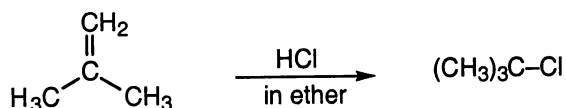
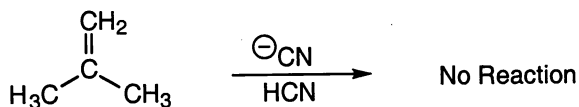
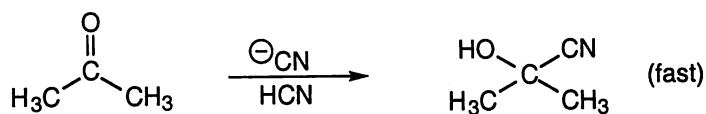


WORKSHOP

Week 18

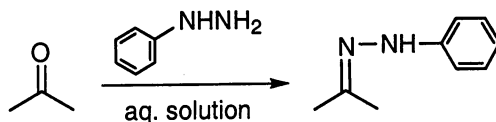
Aldehydes and Ketones: Synthesis and Nucleophilic Additions

1. a. Discuss the similarities and differences in the structures and reactivities of the double bonds of 2-methylpropene and 2-propanone.
- b. With part (a) in mind, account for the following observations. Identify the nucleophile and the electrophile for the first step of each reaction.

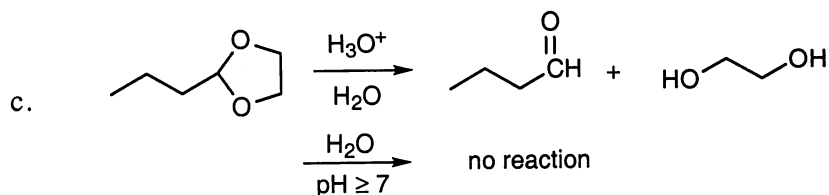
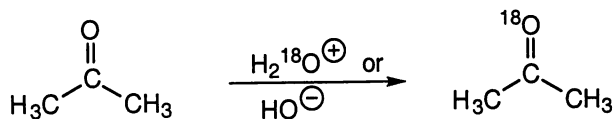


2. Write detailed electron-pushing mechanisms that explain the stated observations.

- a. The following reaction occurs rapidly at pH = 5 but fails at pH = 1.



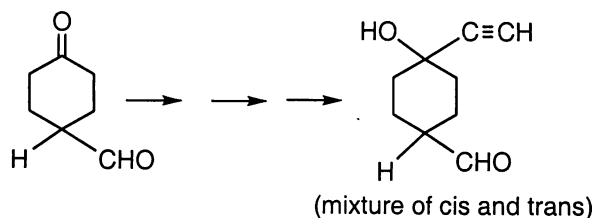
- b. The labeling of acetone with ^{18}O is catalyzed by both acid and base.



3. Propose structures for the lettered compounds.

- a. Compound **X**, $C_7H_{14}O$, gives a silver mirror when treated with $Ag(NH_3)_2^{\oplus}/OH^{\ominus}$. Treatment of the compound with $Zn(Hg)/HCl$ produces 2-methylhexane. The IR spectrum exhibits strong absorption at 1710 cm^{-1} and two moderate absorptions between 2700 and 2800 cm^{-1} . The 1H NMR spectrum shows a one-hydrogen doublet at $\delta\ 9.70$ ($J = 2\text{ Hz}$).
- b. Compound **A**, $C_9H_{12}O$, was optically active, did not give a precipitate with 2,4-dinitrophenylhydrazine, showed a broad IR band at 3400 cm^{-1} , and was readily oxidized to **B**, $C_9H_{10}O$, with aqueous chromic acid (H_2CrO_4) at room temperature. When **A** was refluxed with chromic acid, benzoic acid was obtained. Compound **B** showed strong IR absorption at 1670 cm^{-1} but none at 3400 cm^{-1} and reacted with 2,4-dinitrophenylhydrazine reagent to give **C**. When **B** was reacted with $EtMgBr$ followed by aqueous workup, compound **D** was obtained. **D** did not react with chromic acid reagent at room temperature and showed an IR band at 3400 cm^{-1} . **B** and **D** were optically inactive and could not be resolved.

4. Explain how to selectively carry out the following synthesis



5. Show how to carry out the specified chemical conversions using any necessary organic and inorganic reagents. More than one step may be required.

