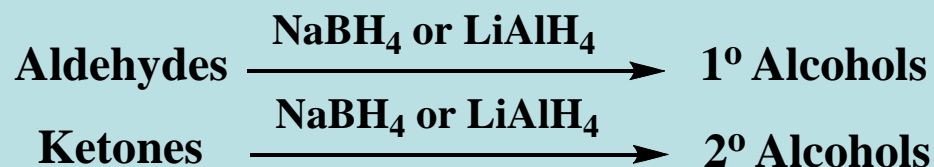


# Review of Other Carbonyl Addition Reactions

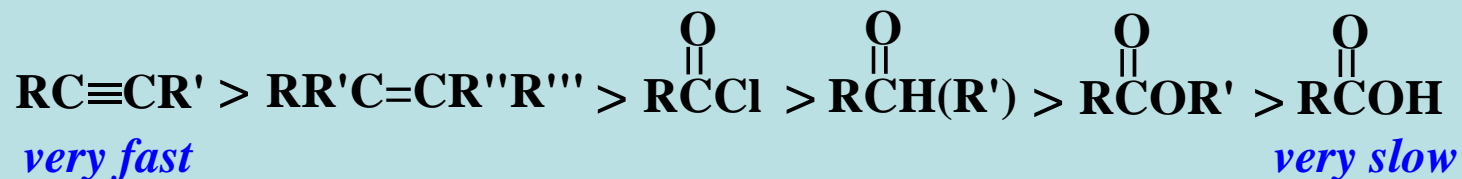
## (1) Reductions

### Hydride additions



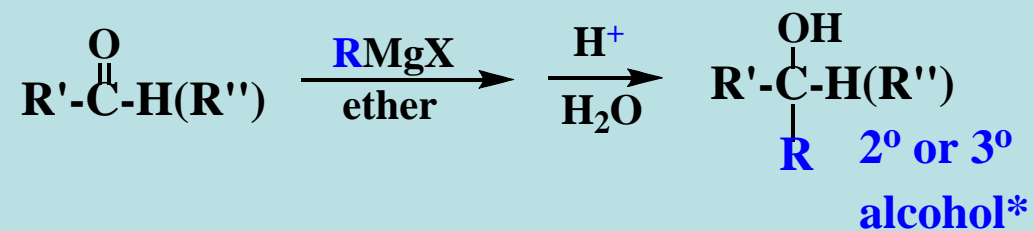
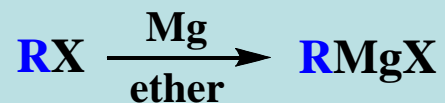
**Catalytic hydrogenation** of aldehydes and ketones occurs but is usually a second choice after metal hydride reduction. Alkenes and alkynes typically hydrogenate faster than aldehydes and ketones, while esters ( $\text{RCO}_2\text{R}'$ ) and carboxylic acids ( $\text{RCO}_2\text{H}$ ) hydrogenate much slower.

### *General reactivity order in catalytic hydrogenation*

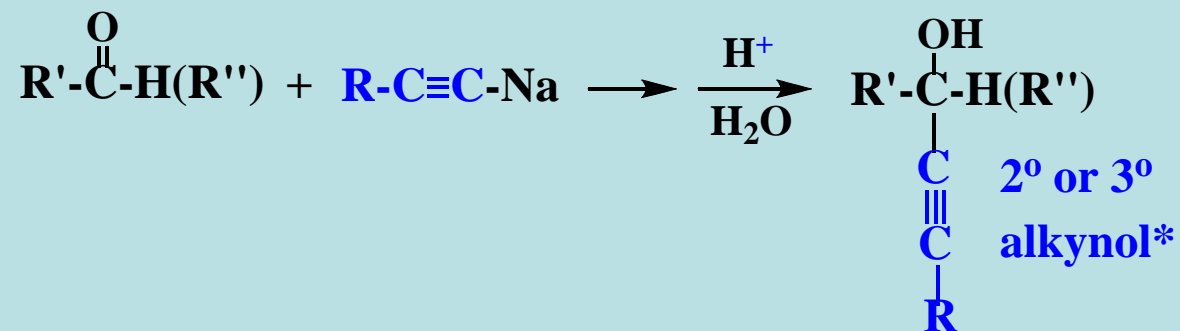


## (2) Addition of Organometallics

Grignard reagents (lithium reagents react analogously)



Sodium alkynides

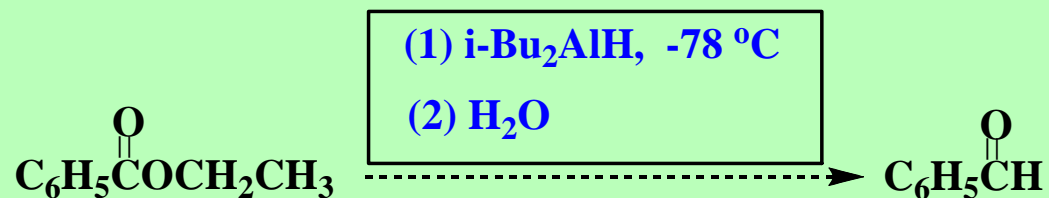
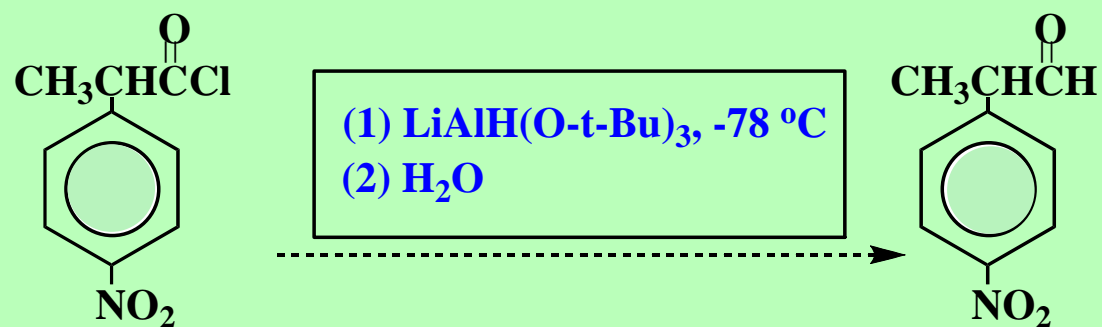
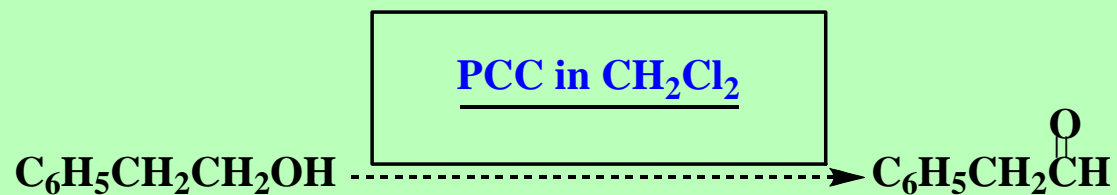


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\* 1° Alcohols may be obtained by use of formaldehyde, HCHO.

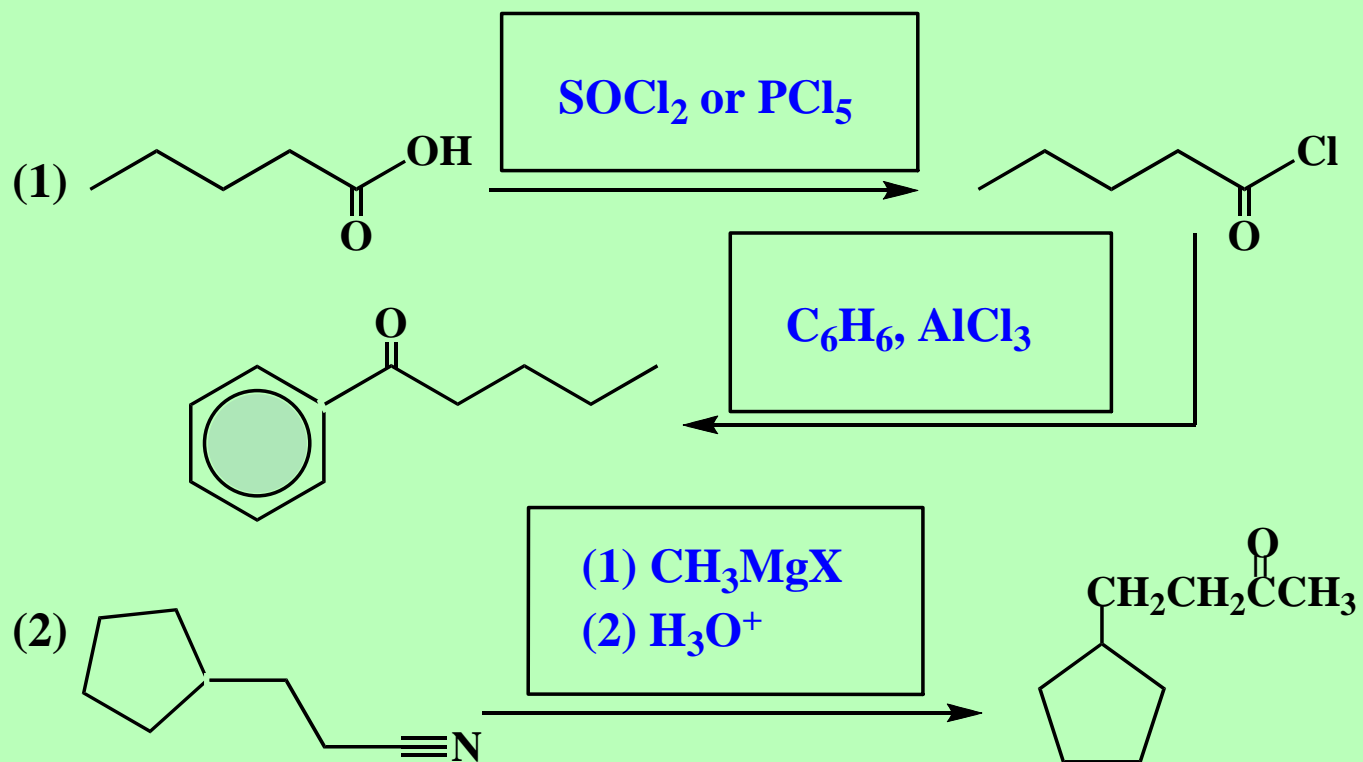
### Quiz 16.02

Provide the needed reagents for the following reactions.



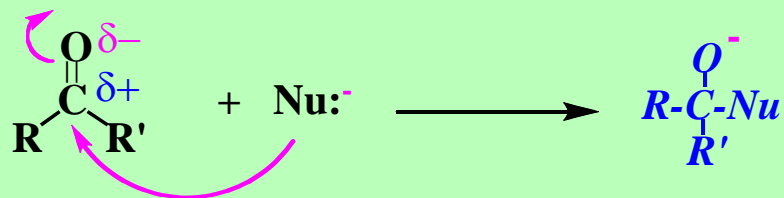
### Quiz 16.03

Specify the reagents needed for the following reactions.



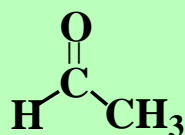
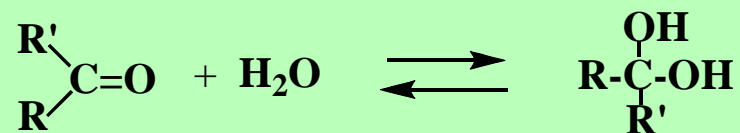
### Quiz 16.04

Below, show the polarization of charge in the carbonyl function of an aldehyde or ketone. Also, use the curved arrow formalism to explain the addition of a nucleophile to the carbonyl group and draw the structure of the product.

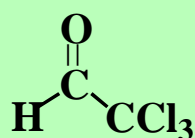


### Quiz 16.05

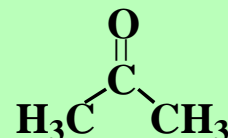
List the three compounds below in the order (largest to smallest) of the magnitude of their equilibrium constants for the hydration reaction below.



I



II

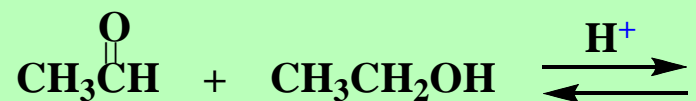


III

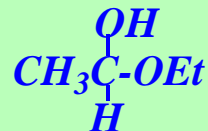
II > I > III

### Quiz 16.06

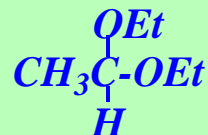
For the reaction of ethanal and ethanol,



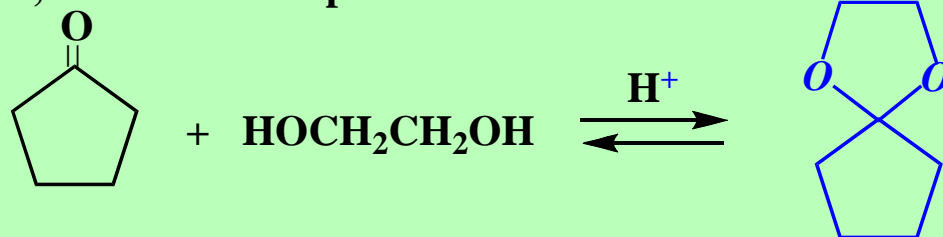
(1) Draw the structure of the hemiacetal.



(2) Draw the structure of the full acetal.

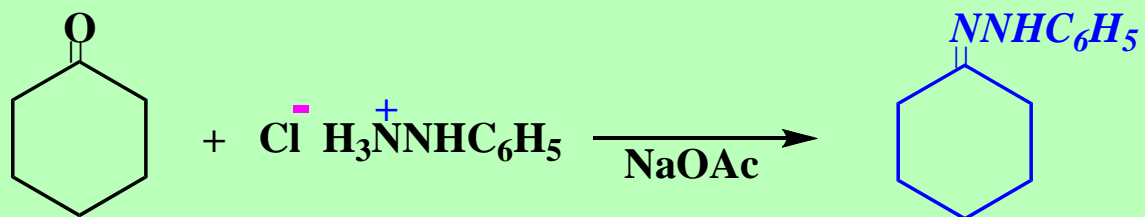


(3) Complete this equation for the reaction of cyclopentanone with 1,2-ethanediol to produce a full acetal.



Quiz 16.08

Draw the structure of the product of the following reaction.



### Quiz 16.10

Draw the missing structures in the following synthetic sequence.

