

17.12  
The Wittig Reaction

*Some reactions of aldehydes and ketones progress beyond the nucleophilic addition stage*

Acetal formation

Imine formation

Compounds related to imines

Enamines

The Wittig reaction

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## *The Wittig Reaction*

Synthetic method for preparing alkenes.

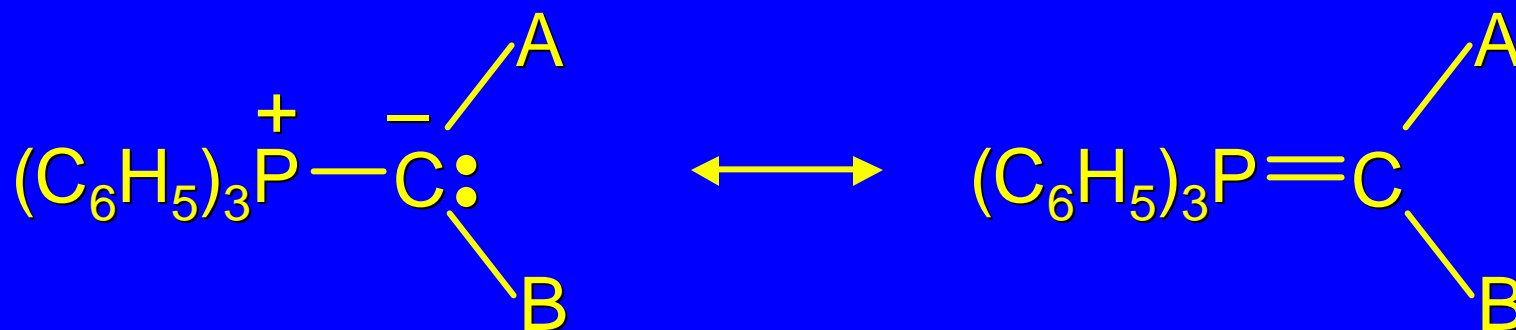
One of the reactants is an aldehyde or ketone.

The other reactant is a phosphorus ylide.

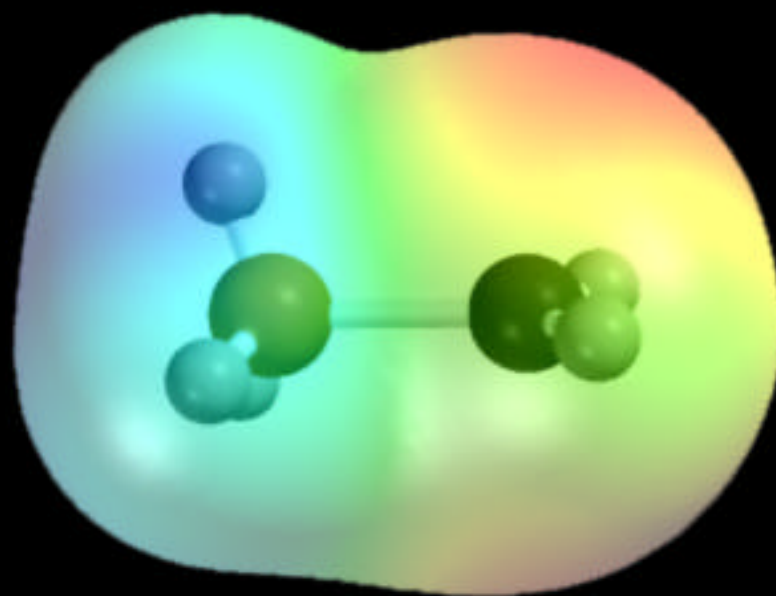
## Phosphorus ylides

R is usually  $\text{C}_6\text{H}_5$  (phenyl)

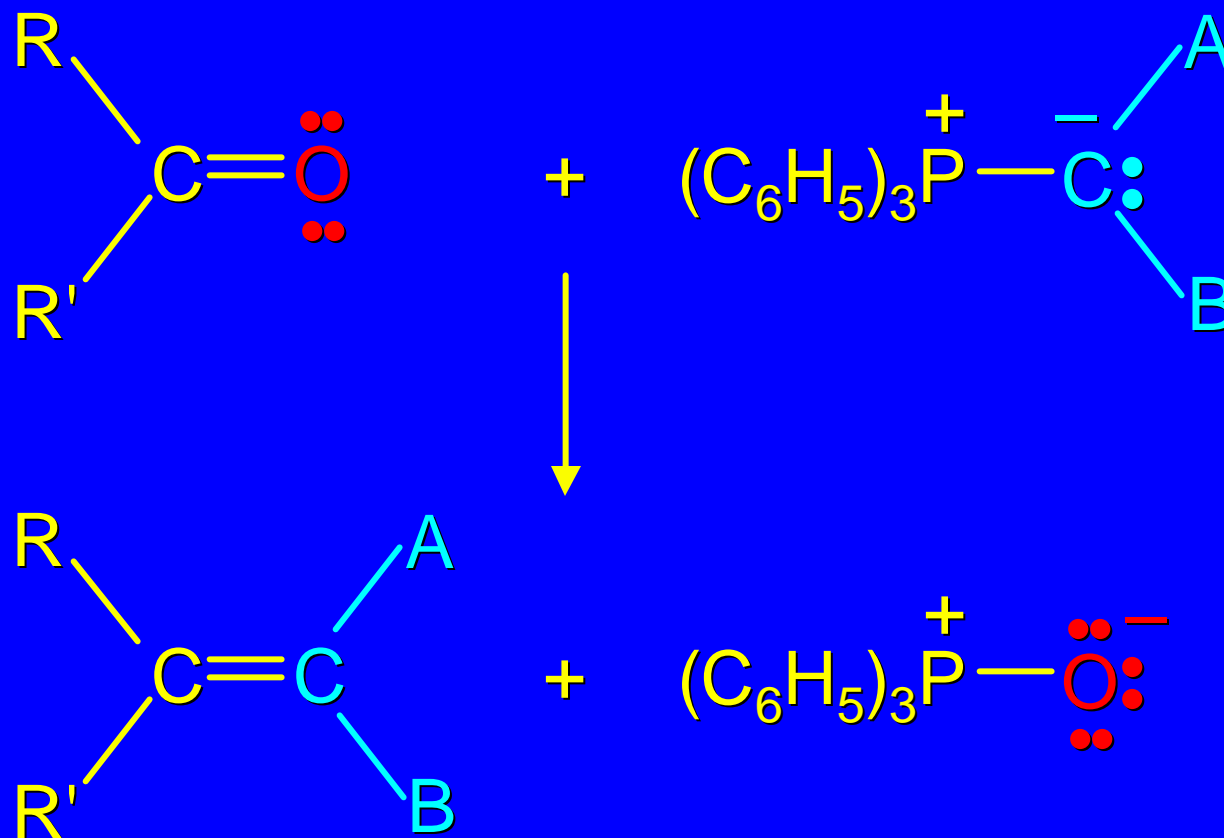
key point is that carbon is negatively polarized and nucleophilic



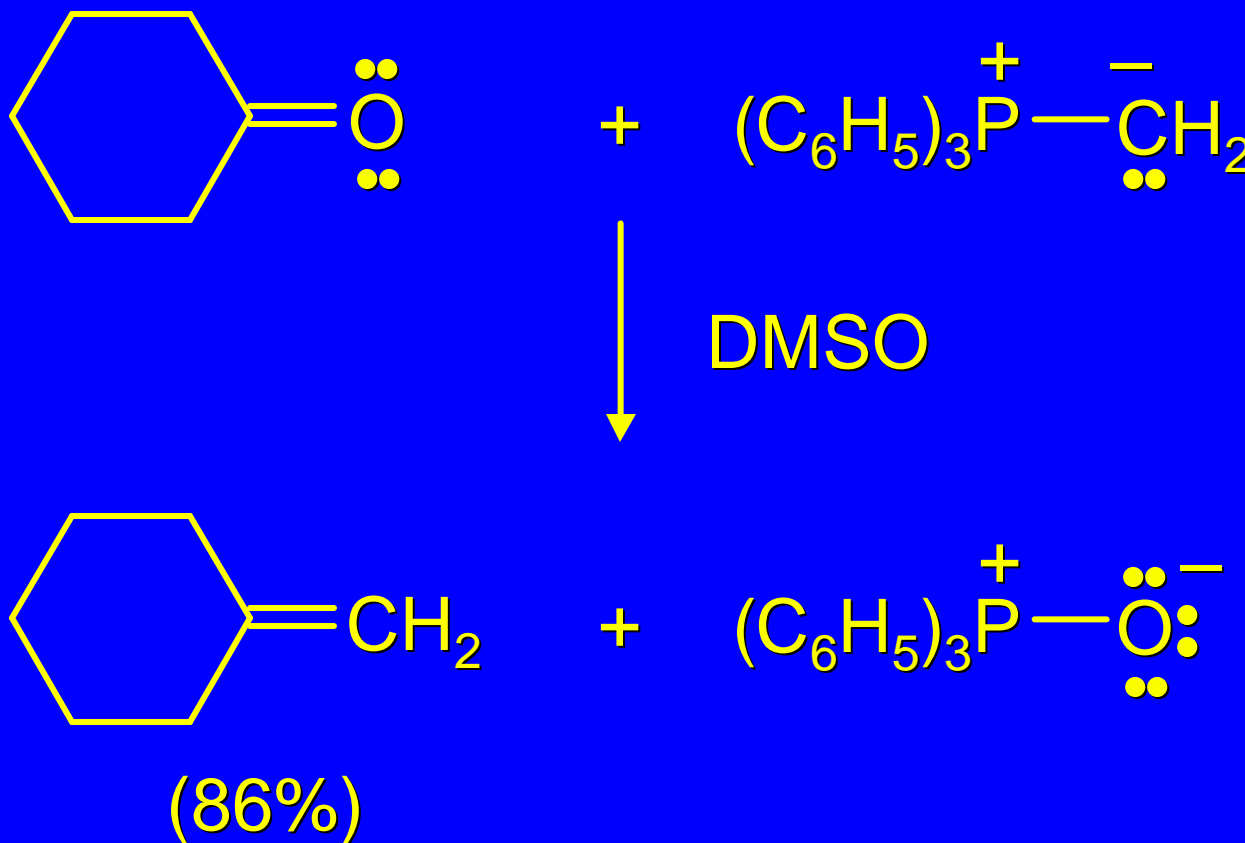
*Figure 17.9 Charge distribution in a ylide*



## The Wittig Reaction



## Example

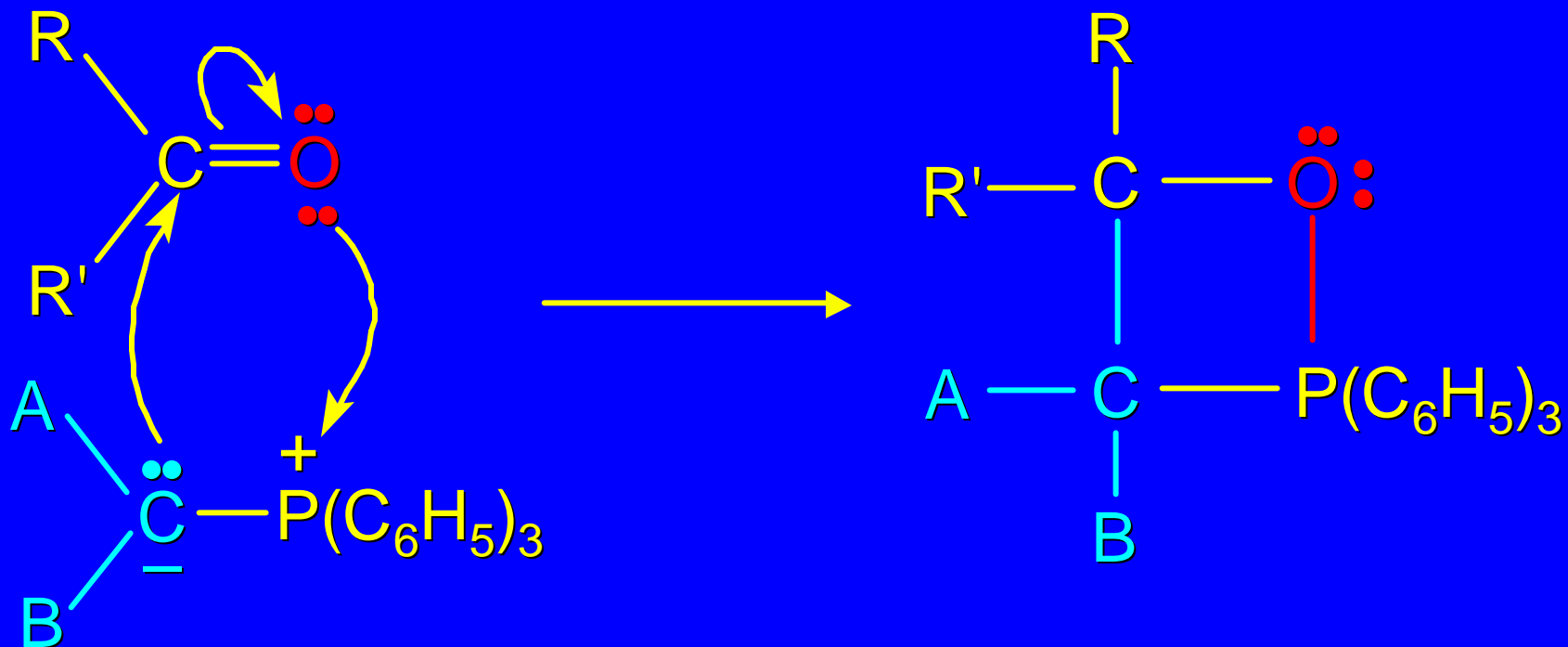


dimethyl sulfoxide (DMSO) or tetrahydrofuran (THF) is the customary solvent



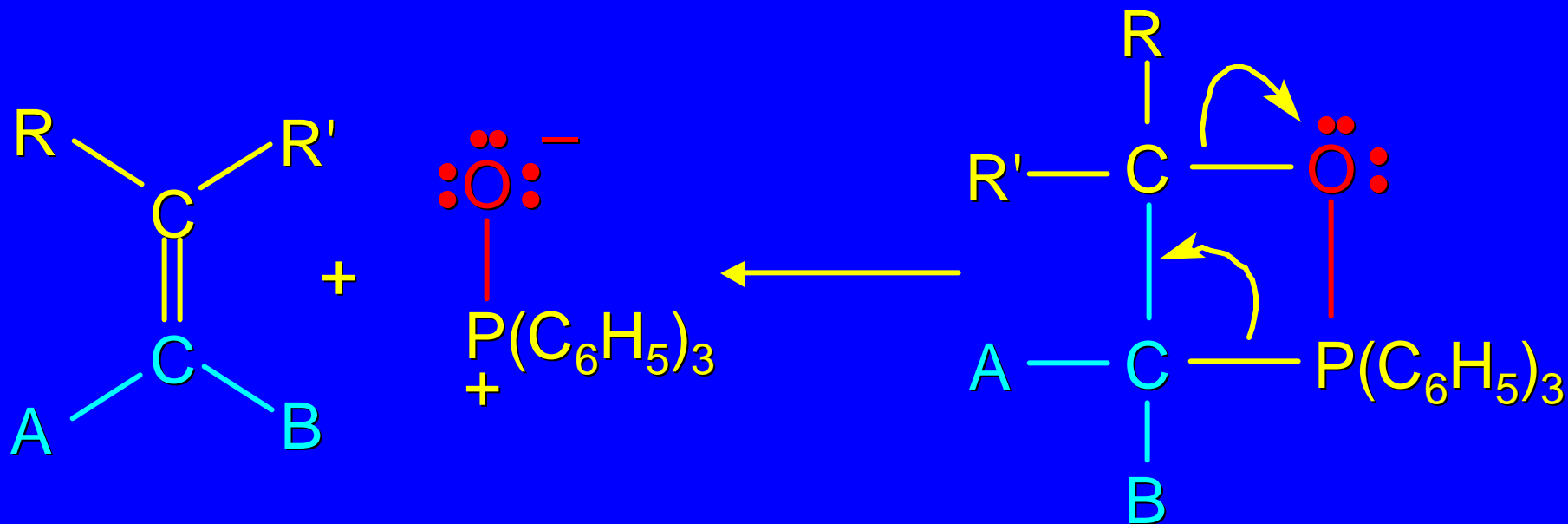
# Mechanism

## Step 1



# Mechanism

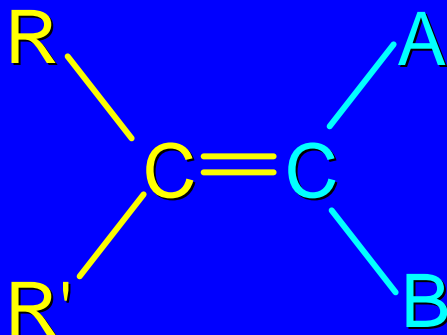
## Step 2



17.13

Planning an Alkene Synthesis via  
the Wittig Reaction

## Retrosynthetic Analysis

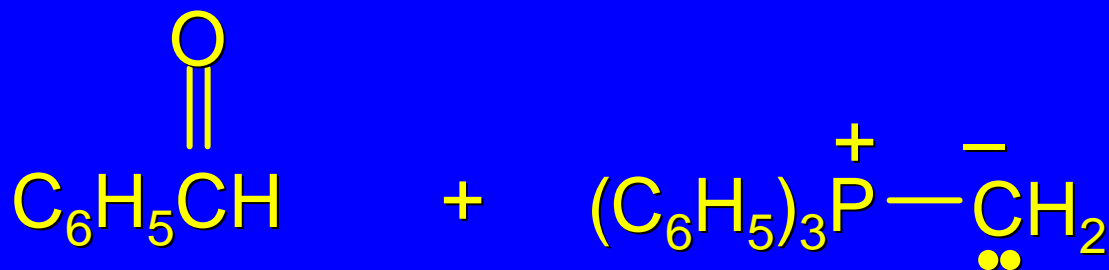
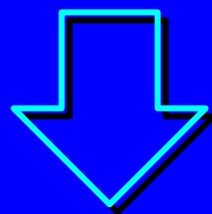


There will be two possible Wittig routes to an alkene.

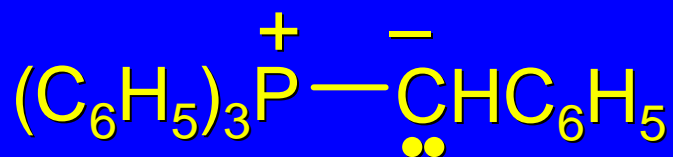
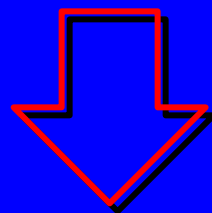
Analyze the structure retrosynthetically.

Disconnect the doubly bonded carbons. One will come from the aldehyde or ketone, the other from the ylide.

## Retrosynthetic Analysis of Styrene



# Retrosynthetic Analysis of Styrene



+



## *Retrosynthetic Analysis*

Both of the routes are acceptable.

## *Preparation of Ylides*

Ylides are prepared from alkyl halides by a two-stage process.

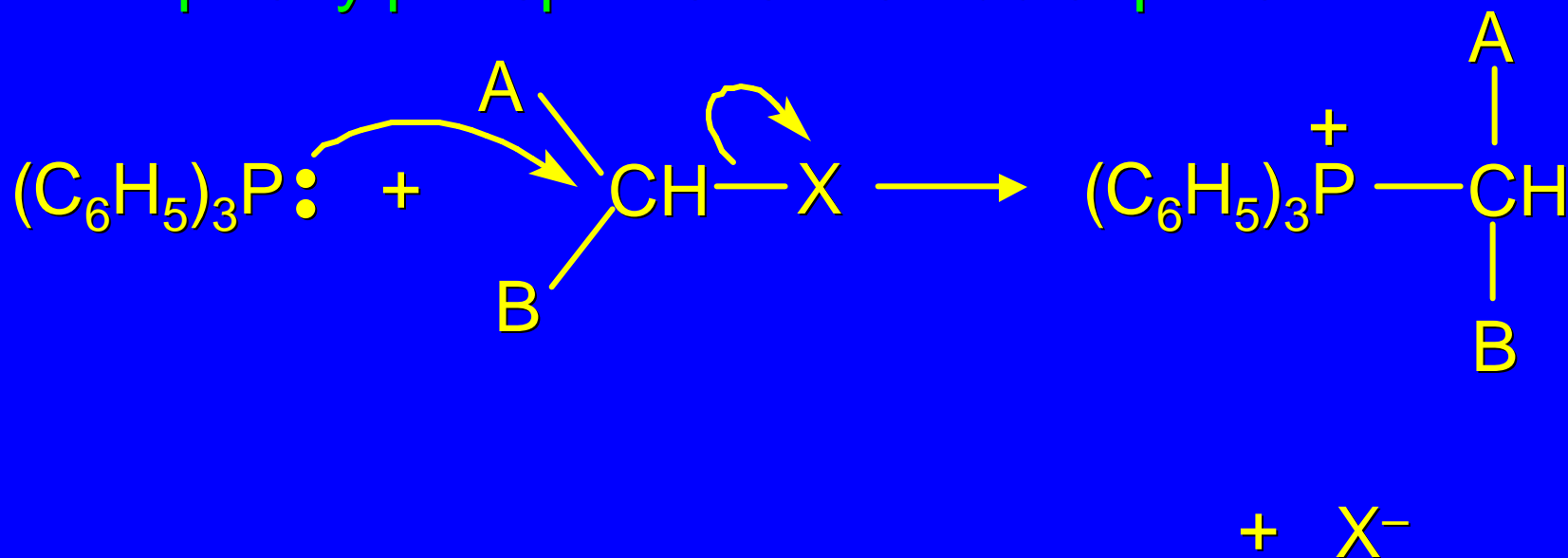
The first step is a nucleophilic substitution. Triphenylphosphine is the nucleophile.



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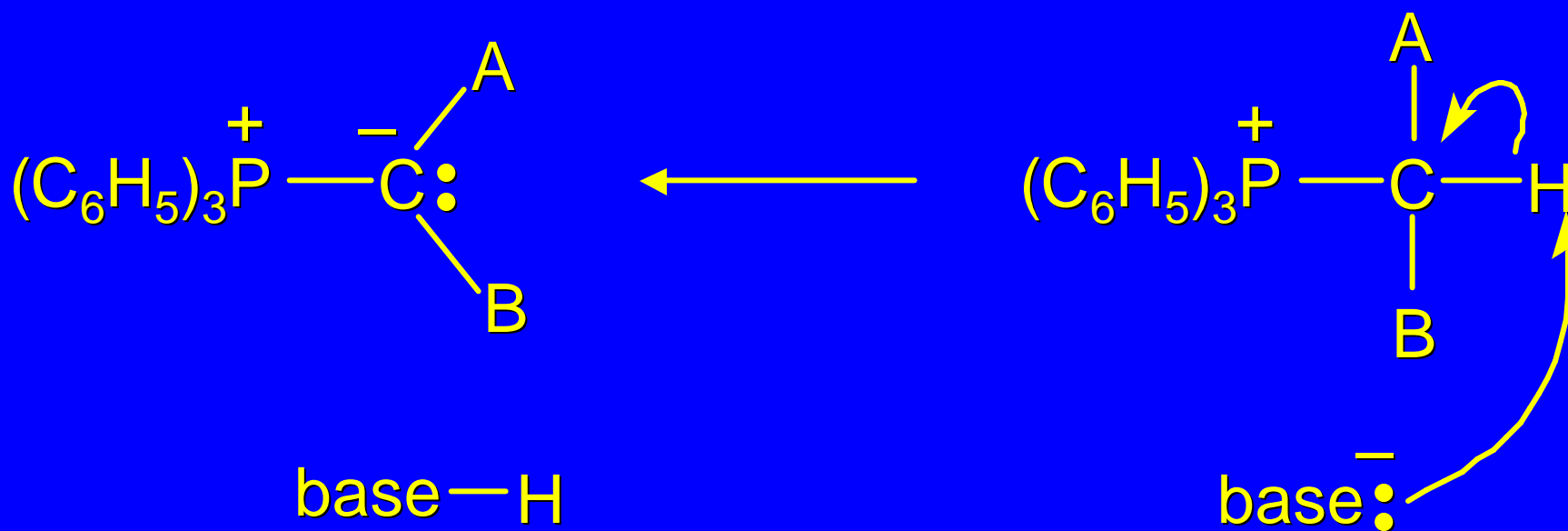


## *Preparation of Ylides*

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## Preparation of Ylides

Typical strong bases include organolithium reagents (RLi), and the conjugate base of dimethyl sulfoxide as its sodium salt [NaCH<sub>2</sub>S(O)CH<sub>3</sub>].

