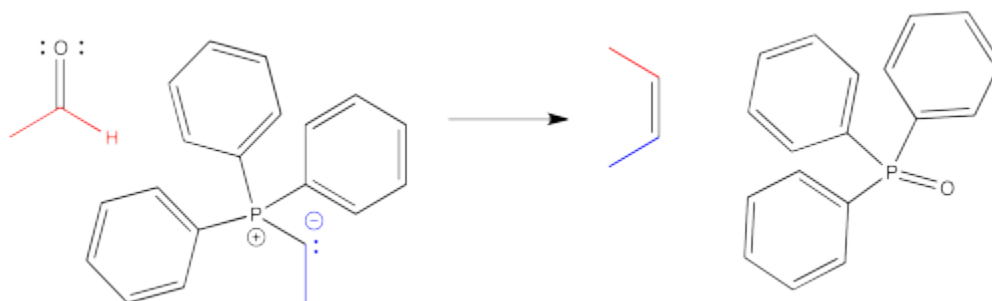


ADDITION OF YLIDES

Sometimes, nucleophiles adding to a carbonyl do not follow the normal reactivity patterns that have been common so far. This is often the case with the addition of ylides.

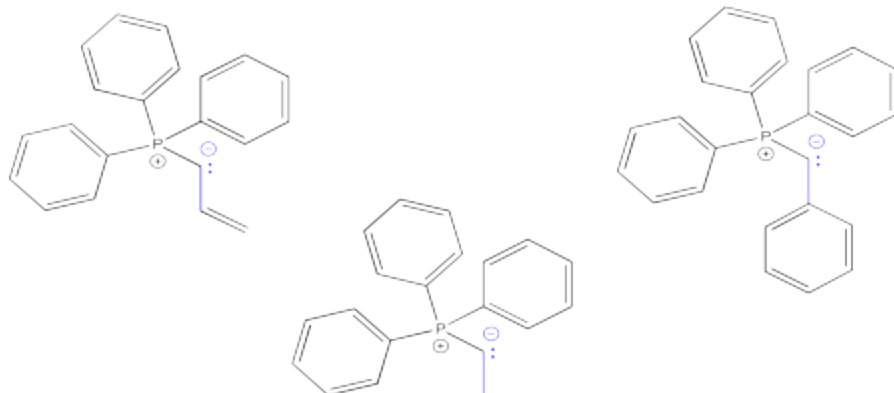
Ylides are compounds that are often depicted with a positive charge on one atom and a negative charge on the next atom. They are examples of zwitterions, compounds that contain both positive and negative charges within the same molecule. What distinguishes them from other zwitterions is the proximity of the opposite charges.

The classic example of an ylide addition to a carbonyl is the Wittig reaction. The Wittig reaction involves the addition of a phosphorus ylide to an aldehyde or ketone. Rather than producing an alcohol, the reaction produces an alkene. The reaction is driven by formation of a phosphorus oxide "side product".

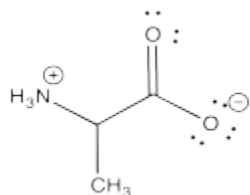


This is a special case. The phosphorus-oxygen bond is strong enough to change the course of this reaction away from the normal pattern, and it isn't something you would have been able to predict based on related reactions.

An ylide is an example of a molecular compound that contains both a positive and a negative formal charge on two adjacent atoms. The charges are right beside each other: in this case, there is a positive charge on the phosphorus and a negative charge on the carbon.



Ylides are specific examples of zwitterions, which are molecules that contain positive and negative charges. The most common example of a zwitterion is probably an amino acid, which contains a positive ammonium ion and a negative carboxylate ion, within the same molecule.



Phosphorus ylides are made one charge at a time. A phosphonium ion must first be assembled, containing the positive charge on phosphorus. This event occurs via a nucleophilic substitution reaction, in which a phosphorus nucleophile displaces a halogen from an alkyl halide.

