

## Wittig Reaction Chemistry Questions with Solutions

**Q1.** Which of the following is used as a reagent in a wittig reaction?

- (a) Monophenyl phosphonium ylide
- (b) Diphenyl phosphonium ylide
- (c) Triphenyl phosphonium ylide
- (d) None of the above

**Answer:** (c) Triphenyl phosphonium ylide is used as a reagent in a wittig reaction.

**Q2.** What is the function of lithium diisopropyl amide (LDA) in the wittig reaction?

- (a) Alpha alkylation
- (b) Beta alkylation
- (c) Gamma alkylation
- (d) None of the above

**Answer:** Lithium diisopropyl amide (LDA) employs alpha alkylation in the wittig reaction.

**Q3.** Lithium diisopropyl amide (LDA) is a/an

- (a) Oxidising agent
- (b) Reducing agent
- (c) Amphoteric amide
- (d) None of the above

**Answer:** Lithium diisopropyl amide (LDA) is a reducing agent.

**Q4.** THF is the abbreviation of

- (a) Tetrahydrofuran
- (b) Trihydrofuran
- (c) Trihalofluoride
- (d) None of the above

**Answer:** (a) THF is the abbreviation of tetrahydrofuran.

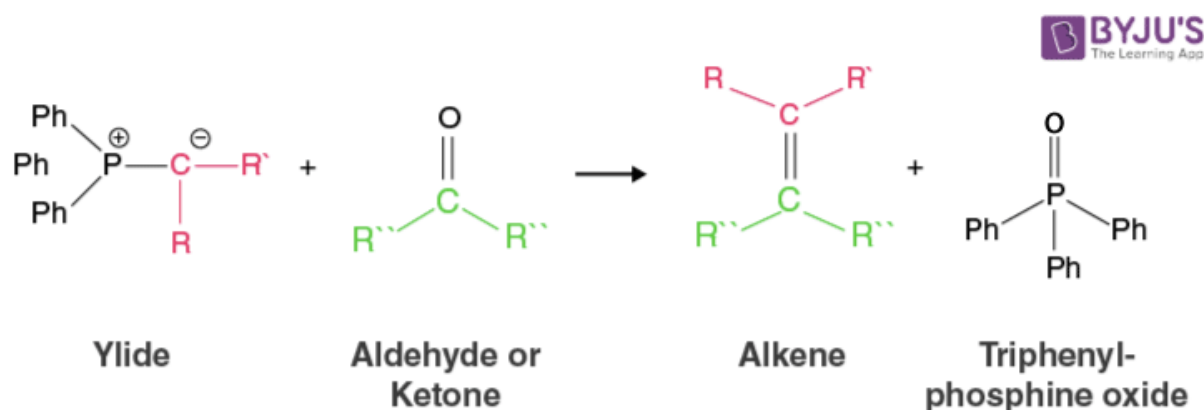
**Q5.** What are the end products of the wittig reaction?

- (a) Alkane and triphenylphosphine oxide
- (b) Alkene and triphenylphosphine oxide
- (c) Alkyne and triphenylphosphine oxide
- (d) None of the above

**Answer:** (b) Alkene and triphenylphosphine oxide are the end products of the wittig reaction.

**Q6.** What is a wittig reaction?

**Answer:** A chemical reaction of an aldehyde or a ketone with triphenyl phosphonium ylide to form an alkene is known as a Wittig reaction.



**Q7.** Why is sodium hydroxide used in the wittig reaction?

**Answer:** Sodium hydroxide is used in the second step of the wittig reaction. It deprotonates the reactant and forms the ylide (Wittig reagent).

**Q8.** What is ylide?

**Answer:** Ylide is a neutral dipolar molecule comprising a negatively charged nucleophile attached to a positively charged heteroatom with a formal positive charge.

**Q9.** Is the first step of wittig reaction  $S_N^2$ ?

**Answer:** Yes, the first step of wittig reaction  $S_N^2$ . Phosphorous substitutes the bromine from the methyl bromide leading to a bimolecular nucleophilic substitution ( $S_N^2$ ) reaction.

**Q10.** Name the functional groups transformed in the wittig reaction.

**Answer:** Hydroxyl, alkoxy, aromatic, nitro and ester groups are transformed in the wittig reaction.

**Q11.** What is the limiting reagent in the Wittig reaction?

**Answer:** Benzyl triphenyl phosphonium chloride acts as a limiting reagent in the wittig reaction.

**Q12.** Which types of isomers are formed in a rearrangement reaction?

**Answer:** Structural isomers are formed in a rearrangement reaction as the bond connectivity changes, but the molecular formula remains the same.

**Q13.** Why do we prefer primary alky halide to synthesise a wittig reagent?

**Answer:** A primary alky halide is preferred to synthesise a wittig reagent as the quaternisation of triphenylphosphine with secondary halides is commonly inefficient.

**Q14.** Is ylide a strong base?

**Answer:** Yes, ylide is a strong base. It is protonated by water, alcohol, or any other acidic hydrogen.

**Q15.** What is the primary difference between betaine and a ylide?

**Answer:** Betaine is a revised amino acid possessing glycine with three methyl groups. In contrast, ylide is a neutral dipolar molecule comprising a negatively charged nucleophile attached to a positively charged heteroatom with a formal positive charge.

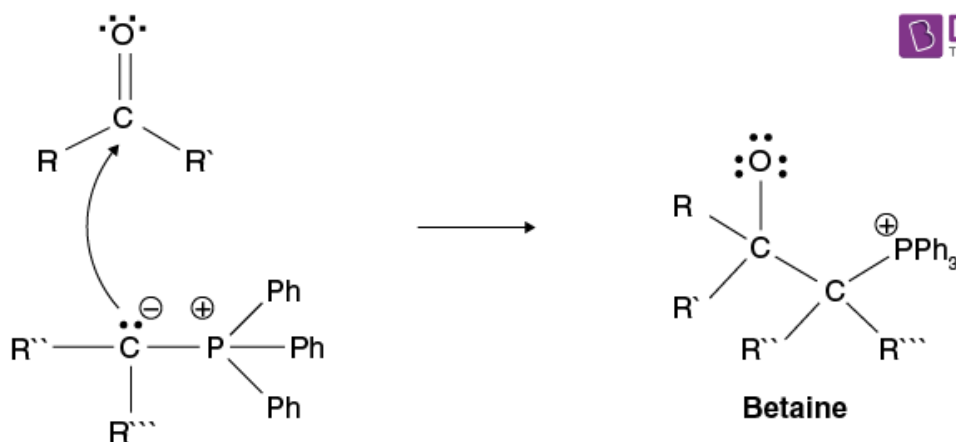
## Practise Questions on Wittig Reaction

**Q1.** Explain the mechanism of the wittig reaction.

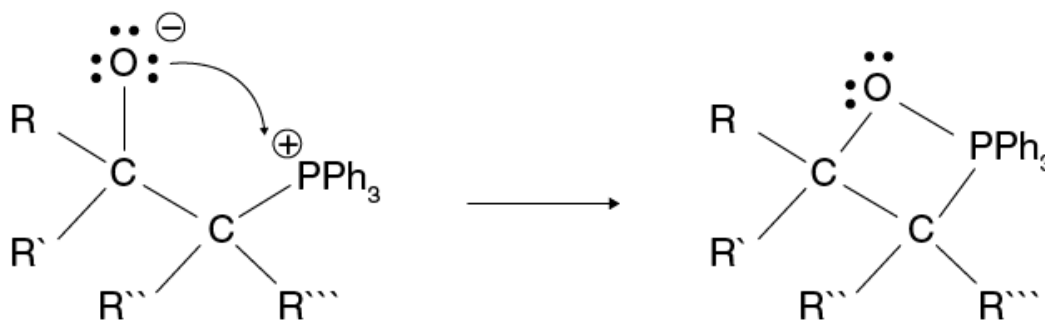
**Answer:** A chemical reaction of an aldehyde or a ketone with triphenyl phosphonium ylide to form an alkene is known as a Wittig reaction.

**Mechanism of Wittig reaction:**

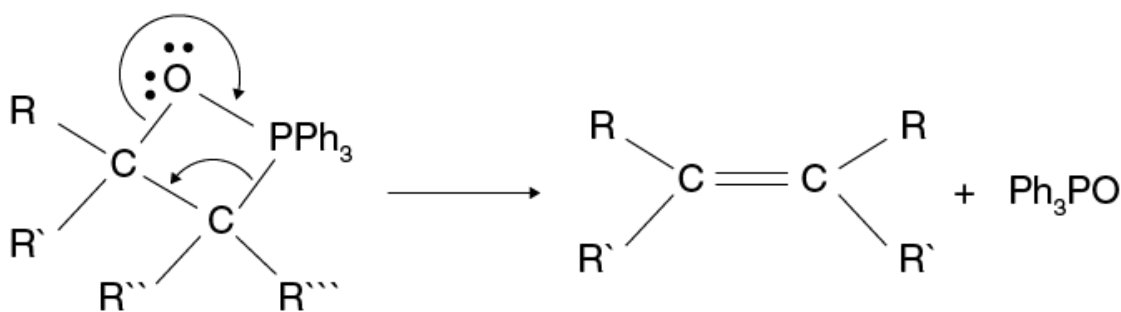
**Step 1: Reaction of a carbonyl compound with a tertiary phosphine to produce a phosphonium salt.**



**Step 2: Formation of a four-membered ring.**



**Step 3: Formation of the alkene**



**Q2.** What are the advantages of the wittig reaction?

**Answer:** A chemical reaction of an aldehyde or a ketone with triphenyl phosphonium ylide to form an alkene is known as a Wittig reaction.

**Advantages of Wittig reaction:**

- Alkenes can be synthesised from aldehydes or ketones by this method.
- We can easily predict the geometry of the double bond if the ylide's nature is known.

**Q3.** What are the disadvantages of the wittig reaction?

**Answer:** A chemical reaction of an aldehyde or a ketone with triphenyl phosphonium ylide to form an alkene is known as a Wittig reaction.

**Disadvantages of Wittig reaction:**

- Both the E and the Z double bond isomers can be formed.
- The reaction speed is very slow when sterically hindered ketones are used. The yield is also low for these reactions.

- Aldehydes can easily undergo oxidation, decomposition, or even polymerisation.

**Q4.** How can we synthesise a Wittig reagent?

**Answer:** Wittig reagent is prepared from a phosphonium salt, which is prepared by the quaternisation of triphenylphosphine with an alkyl halide. Wittig reagents are from a primary alkyl halide as the quaternisation of triphenylphosphine with secondary halides is typically inefficient.

**Q5.** What is the primary difference between ylide and zwitter ion?

**Answer:** Ylide is a type of zwitter ion, a molecule containing positive and negative charges. The most familiar example of a zwitter ion is an amino acid, which contains a positive ammonium ion and a negative carboxylate ion within the same molecule.

