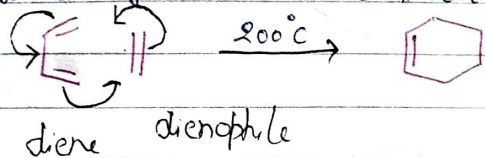
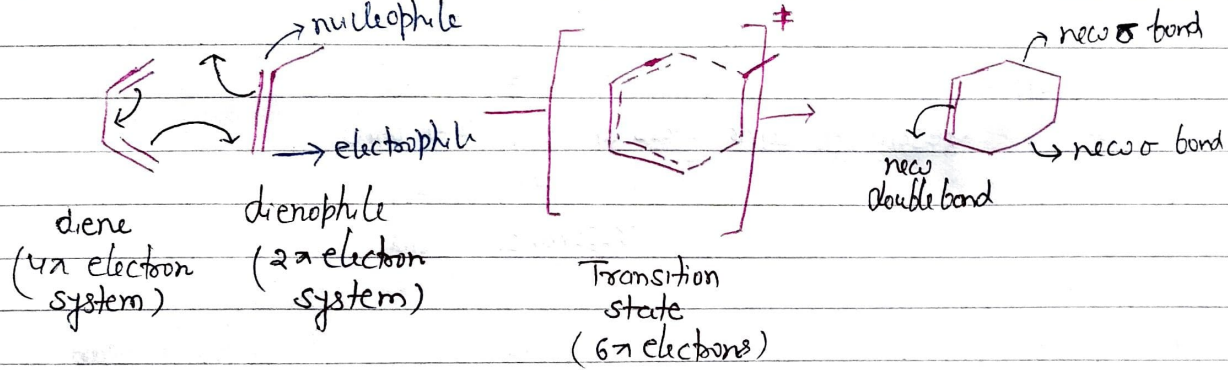


Diels Alder Reaction: Diels-Alder reaction is a chemical reaction between a conjugated diene and a substituted alkene (commonly known as dienophile) to form a cyclohexene derivative.

It is an example of pericyclic reaction with a concerted mechanism. The reaction is initiated thermally or by Lewis acid catalyst with or without use of the solvents.

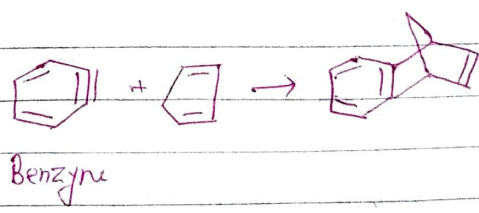
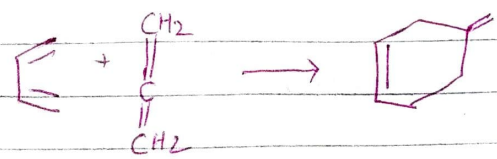
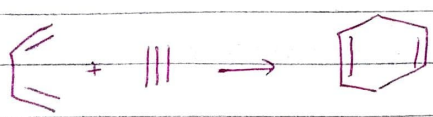


Concerted reaction mechanism:

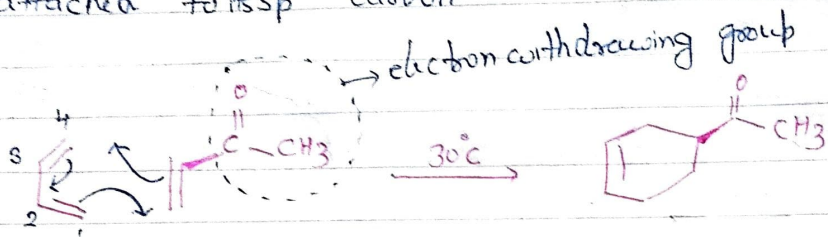


Diels Alder reaction are also called as [4+2] cycloaddition reaction because six π electrons are involved in the cyclic transition state, four comes from the conjugated diene and two comes from the dienophile. The reaction, in essence, converts two π bonds into two σ bonds.

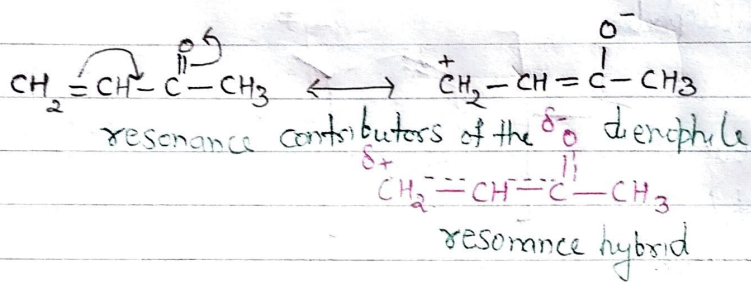
Tripole bond compounds, allenes and benzyne may also function as dienophile.



note 1: The reactivity of dienophile is increased if one or more electron withdrawing group (such as $>C=O$, $-CHO$, $-COOR$, $-CN$, $-NO_2$, etc) are attached to its sp^2 carbon.

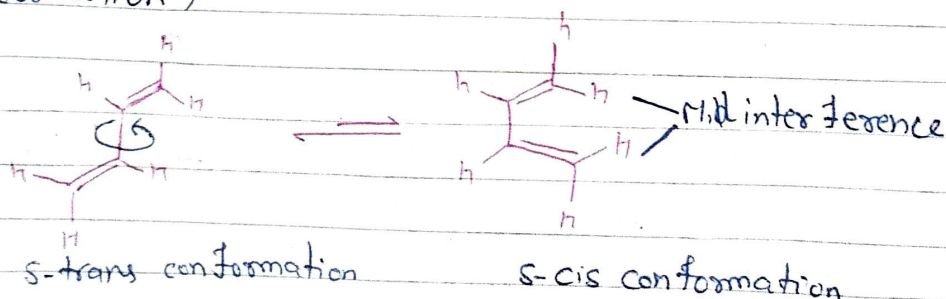


Electron withdrawing group withdraws electron from the double bond. This puts a partial positive charge on one of its sp^2 carbon, making Diels-Alder reaction easier to initiate.



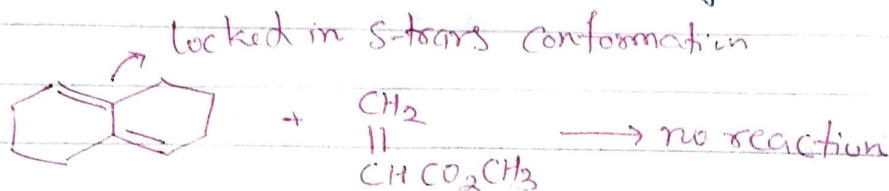
The partial positive charged sp^2 carbon of the dienophile can be ~~likened~~ likened to the electrophile that is attacked by π electrons from C-1 of the conjugated diene. The other sp^2 carbon of the dienophile is the nucleophilic that adds to C-4 of the diene.

note 2: The reaction occur with the cisoid form (s-cis conformation) of the diene. Cyclic dienes are naturally in the cisoid form and so react more rapidly than the acyclic diene which normally exist in the more stable transoid form (s-trans conformation).

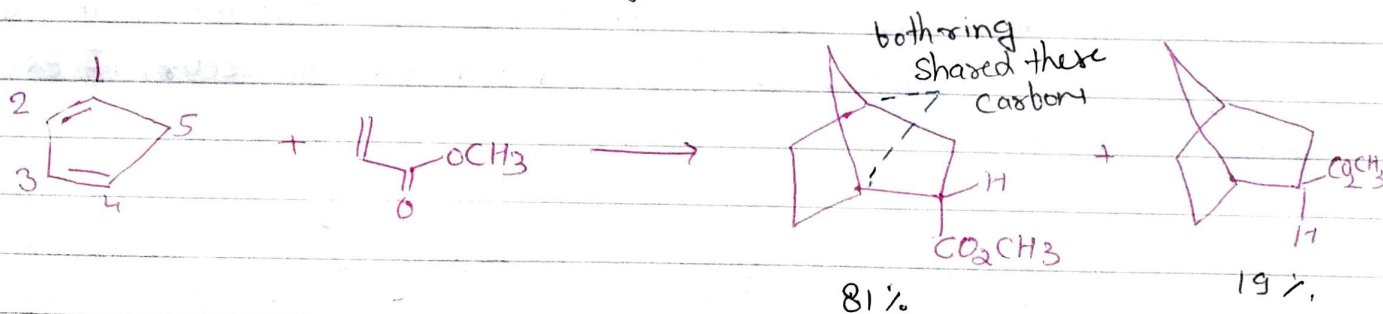


In order to participate in a Diels-Alder reaction, the conjugated diene must be in an s-cis conformation because in s-trans conformation, the number 1 and 4 carbon are too far apart to react with the dienophile.

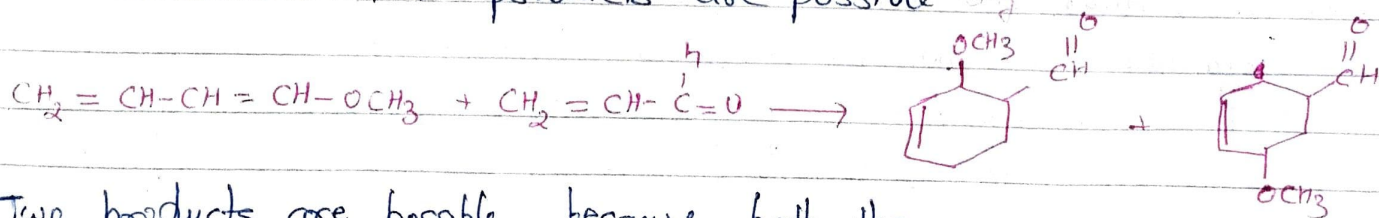
A conjugated diene that is locked in an s-trans conformation can not undergo a Diels-Alder reaction.



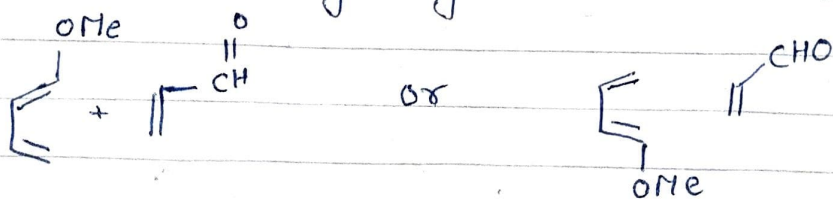
A conjugated diene that is locked in a s-cis conformation, such as 1,3-cyclopentadiene, is highly reactive in a Diels-Alder reaction. When the diene in a cyclic compound, the products of a Diels-Alder reaction is a bridged bicyclic compound (A compound that contain two rings that share two non adjacent carbons).



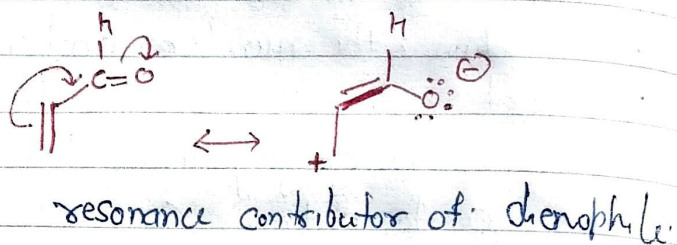
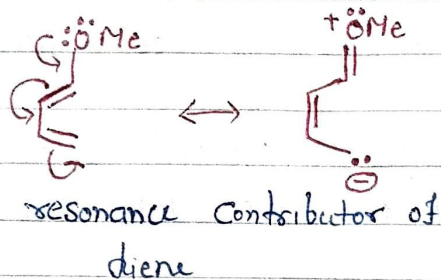
note 3: When both the diene and dienophile are unsymmetrically substituted, two products are possible e.g.



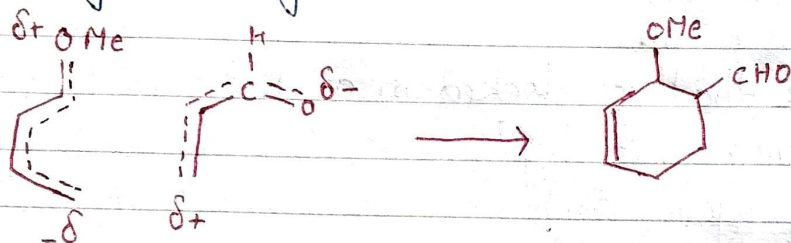
Two products are possible because both the reactant can be e.g. aligned in two different ways.



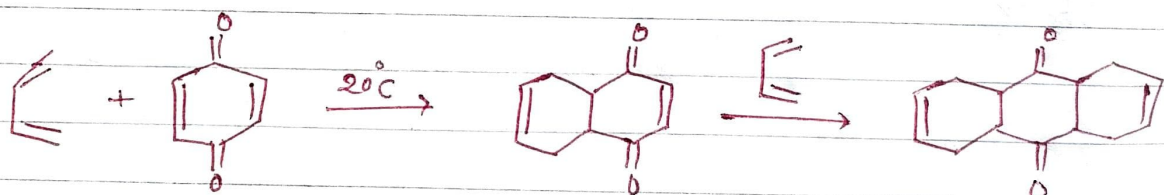
Which product will be formed depends on the charge distribution in each of the reactants



The partial positive charge of the dienophile will bond preferentially to the partial negative charged carbon of the diene. Therefore -



note 4: If the diene has two dienophile has two carbon-carbon double bond, two successive Diels-Alder reactions can occur, if excess diene is available.



note 5: Diels-Alder reaction is a syn addition reaction with respect to both the diene and the dienophile. Therefore if the substituents in the dienophile are cis, they will be cis in product. If the substituents in the dienophile are trans, they will be trans in product.

