B.Sc. Semester-VI
GroupA / DSE-4
Organic Synthesis

II. Pericyclic Reactions

6. Diels-Alder Reaction

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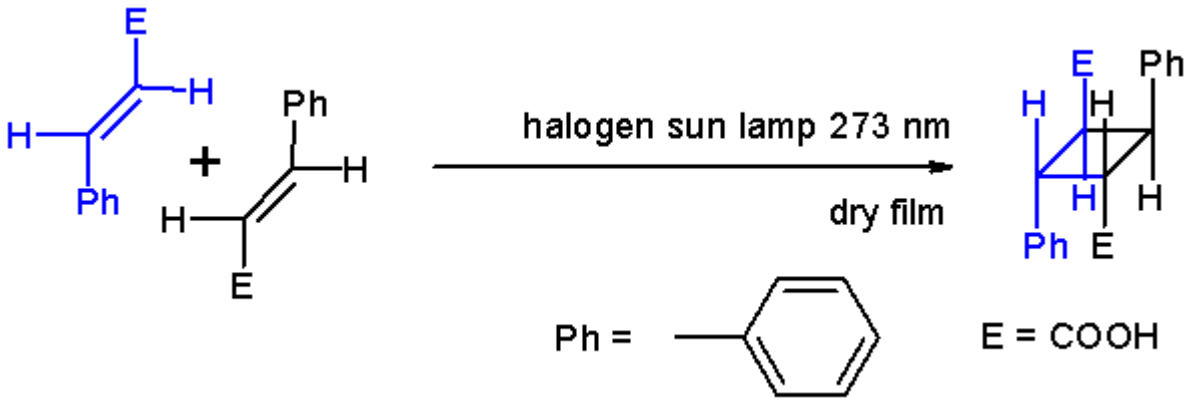
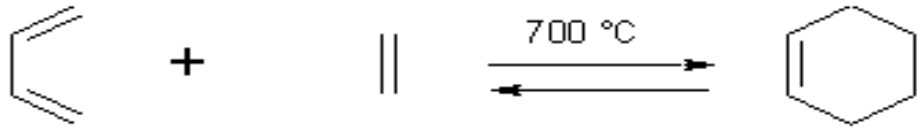
Cycloaddition Reaction

A **cycloaddition** is a reaction, in which two π bonds are lost and two σ bonds are gained. The resulting reaction is a cyclization reaction.

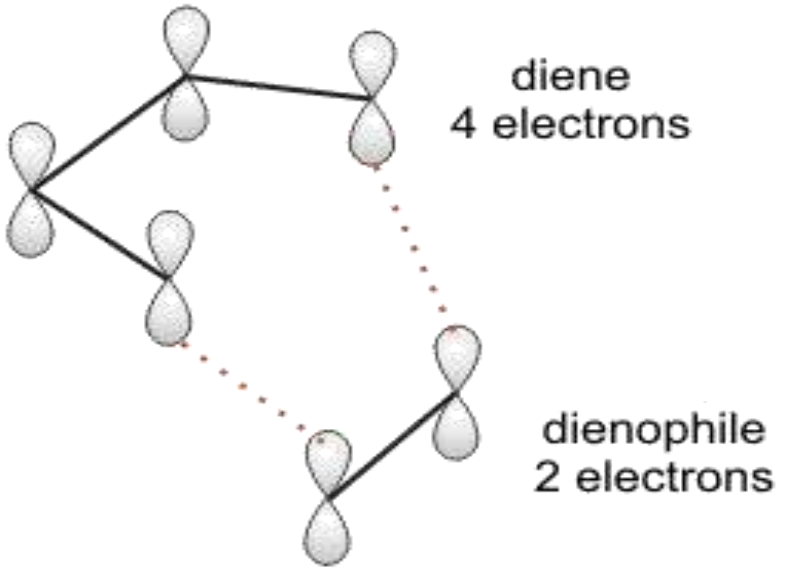


4+2 Cycloaddition Reaction (Supra-Supra)



The Diels-Alder reaction represents the prototype of cycloadditions. Besides the Grignard reaction, it is the most cited name reaction in chemical literature.

The reaction principle was discovered in 1928 by **Otto Diels** and his student **Kurt Alder**. Both were honored with the Nobel Prize for Chemistry in 1950.



Otto Diels
1876-1954

Kurt Alder
1902-1958

The reaction principle was discovered in 1928 by **Otto Diels** and his student **Kurt Alder**. Both were honored with the Nobel Prize for Chemistry in 1950.

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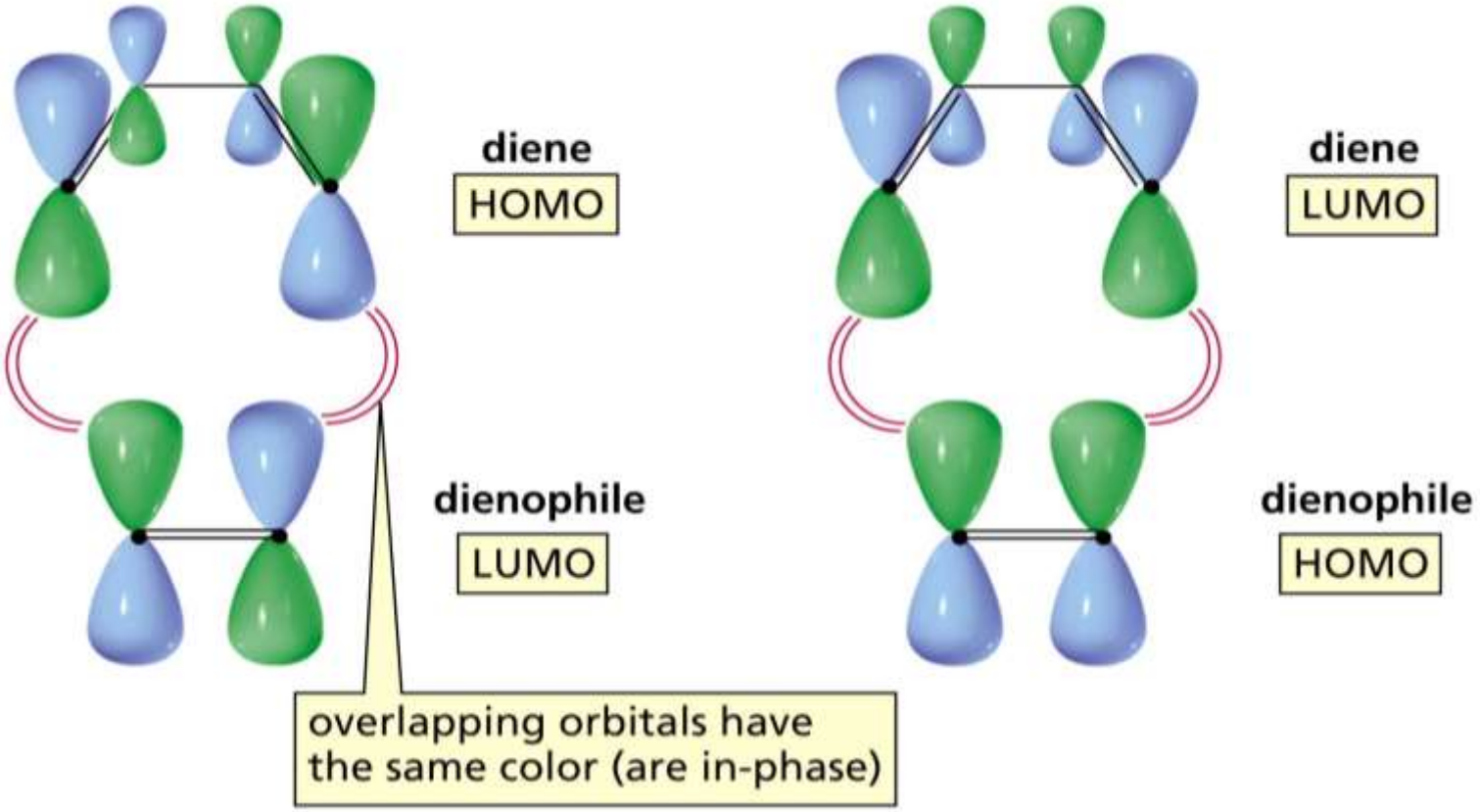
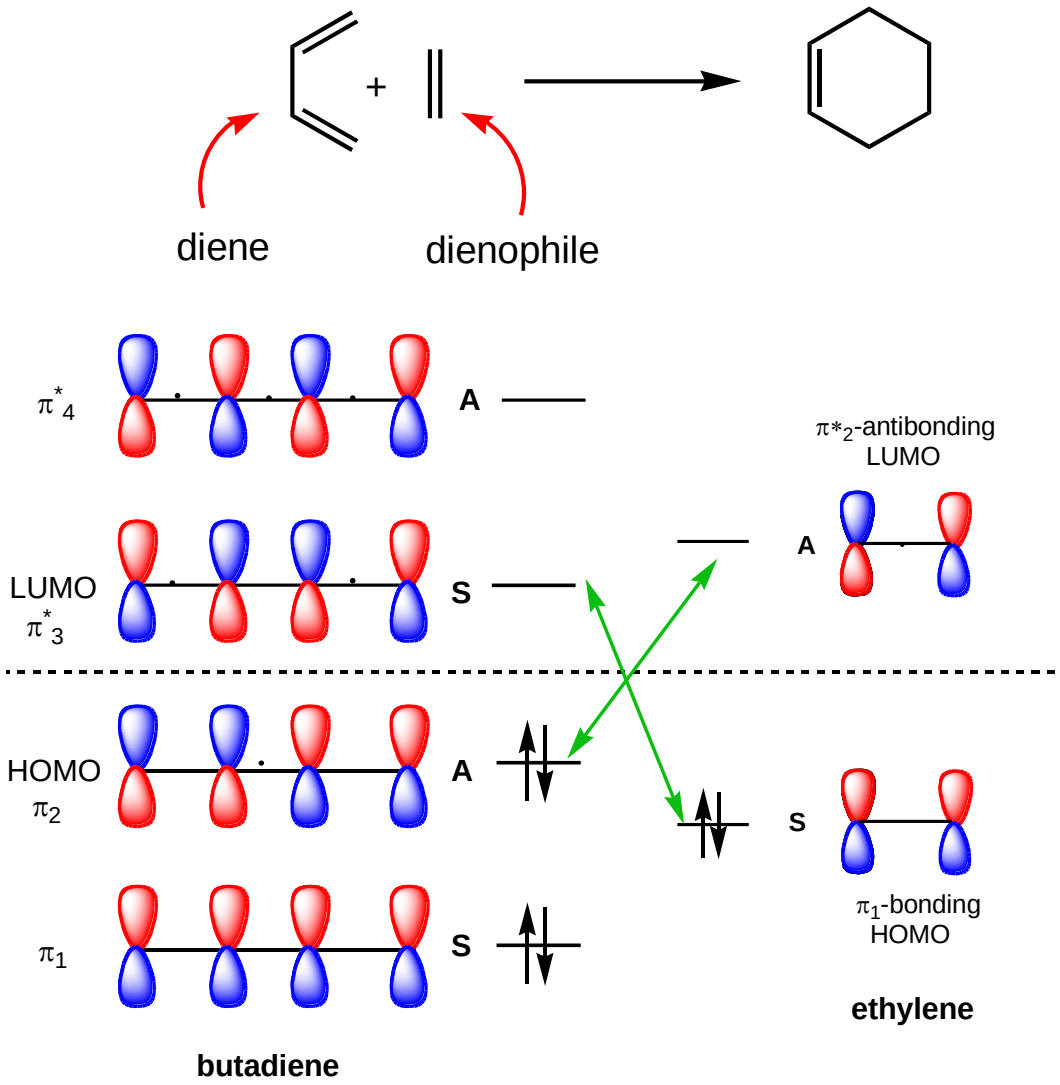
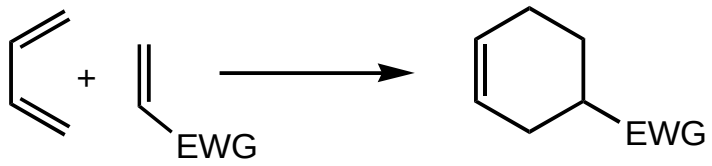
Diels-Alder Cycloaddition : Frontier Orbital Intractions
6-e, 4+2 Supra-supra



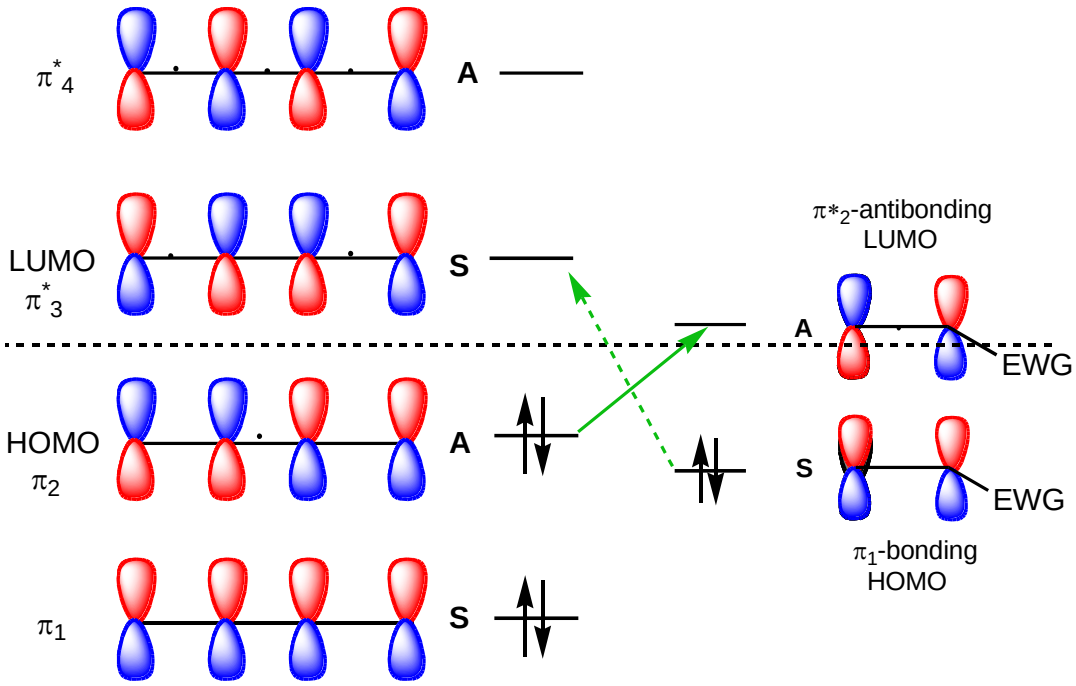
Diels-Alder Reaction
An Allowed [4+2] Cycloaddition



Diels-Alder Reaction:
The Effect of Electron Withdrawing Groups

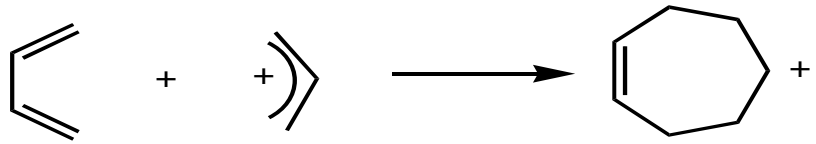


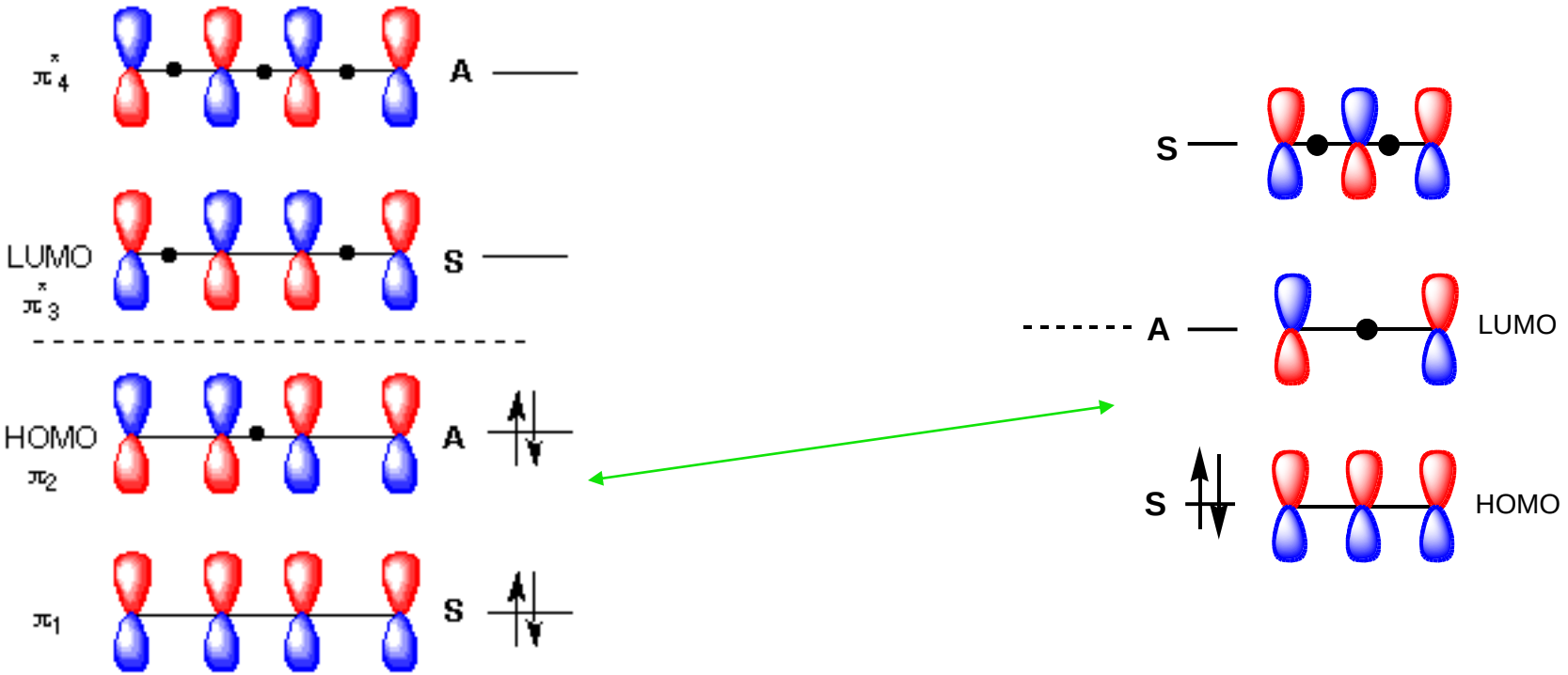
diene dienophile



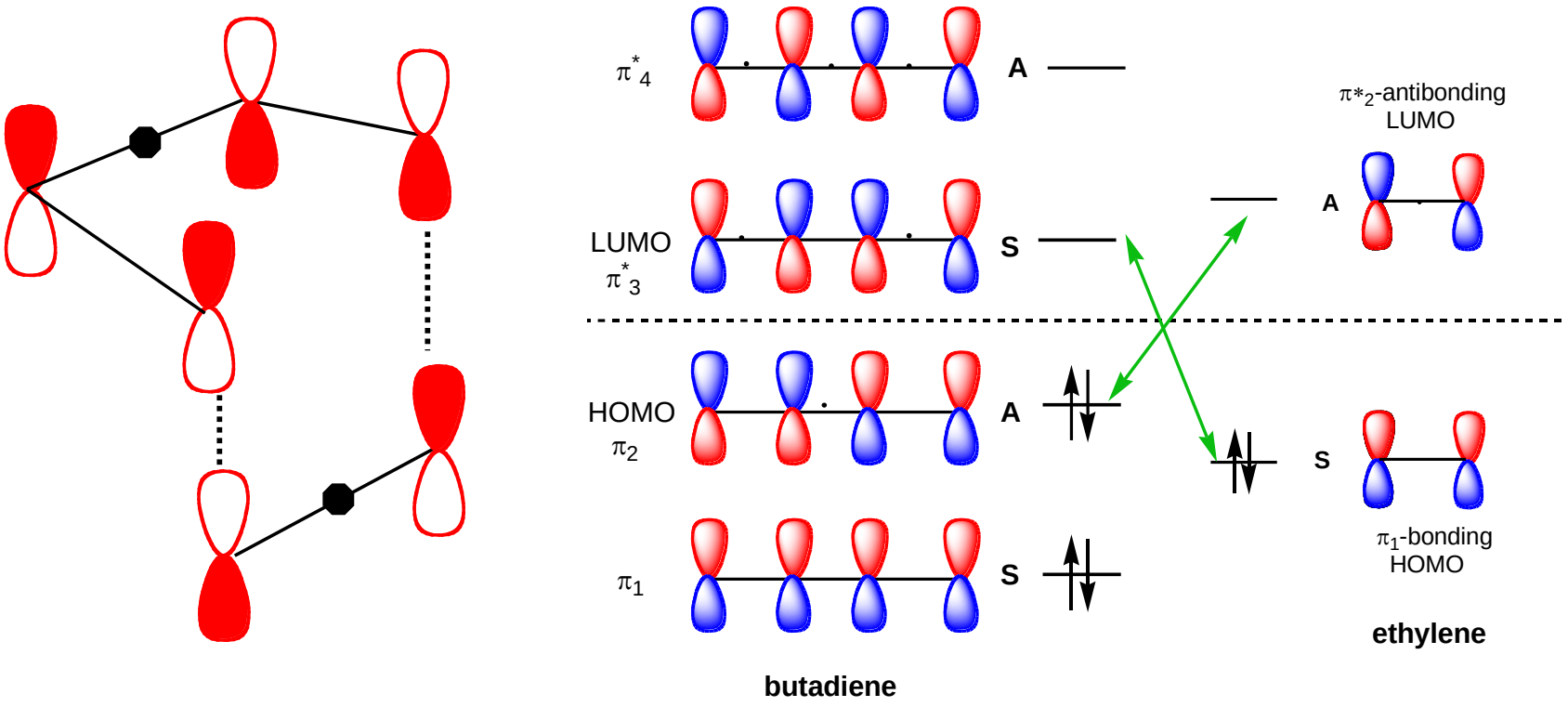
butadiene **deactivated ethylene**

[4+2]-Cycloaddiitions of Propenyl System

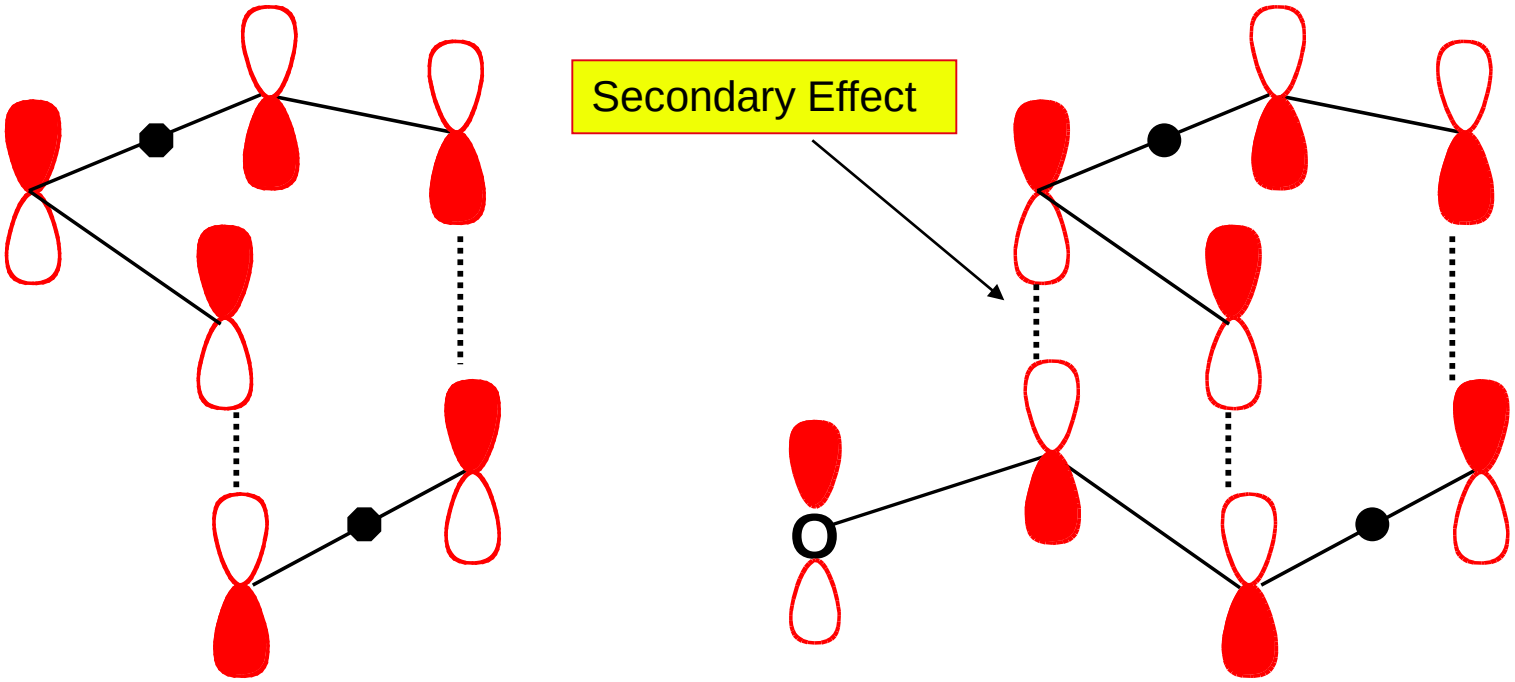




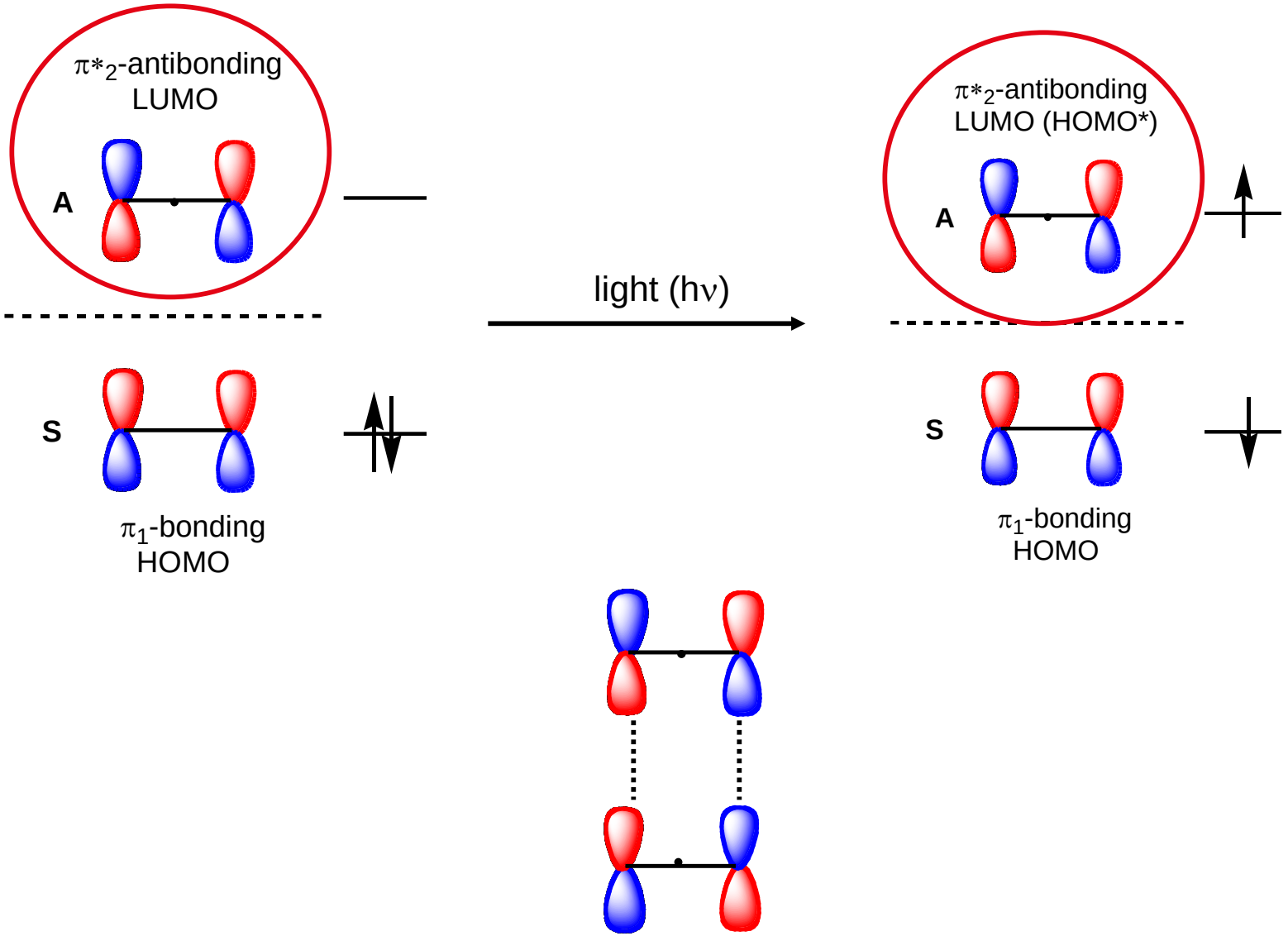
Diels-Alder Reaction: Mechanism



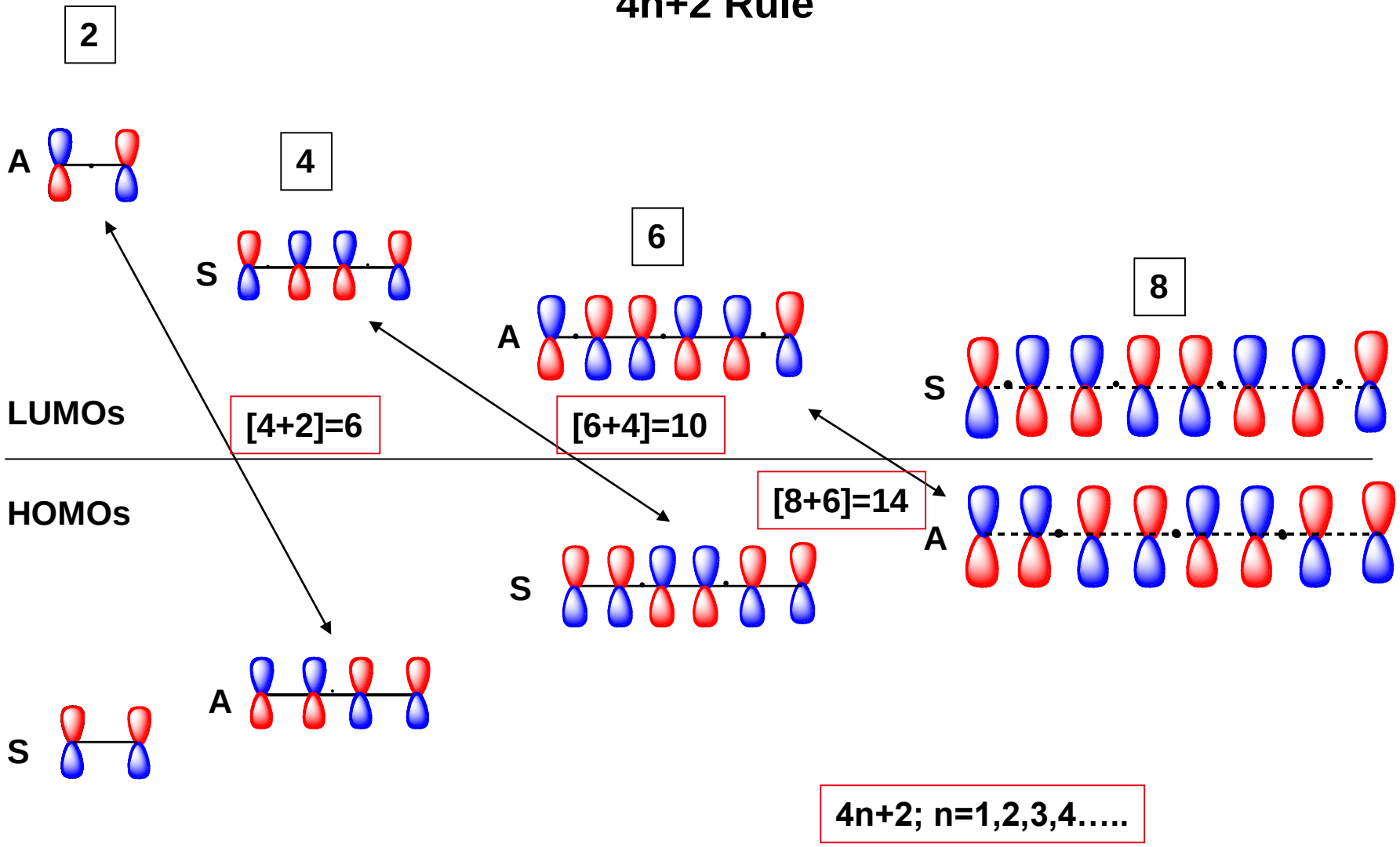
Diels-Alder Reaction: The Endo Effect



A [2+2] Cycloaddition Reaction

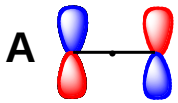


Thermally Allowed Cycloadditions : Selection Rule
4n+2 Rule

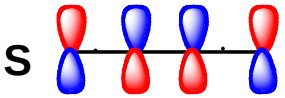


Photochemically Allowed Cycloadditions :Selection Rule
4n Rule

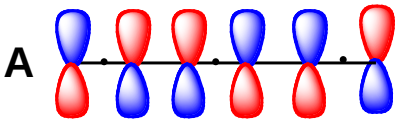
2 [2+2]=4



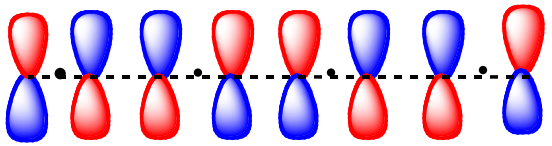
4 [4+4]=8



6 [6+6]=12

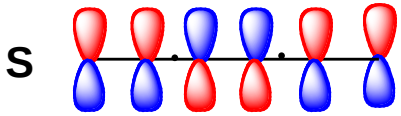


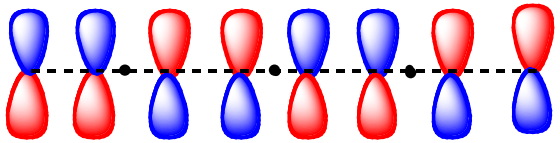
8 [8+8]=16

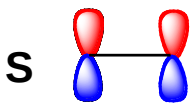


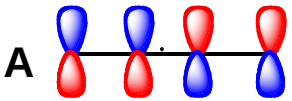
LUMOs

HOMOs









4n; n=1,2,3,4…..

and [2+6]=8; [8+4]=12

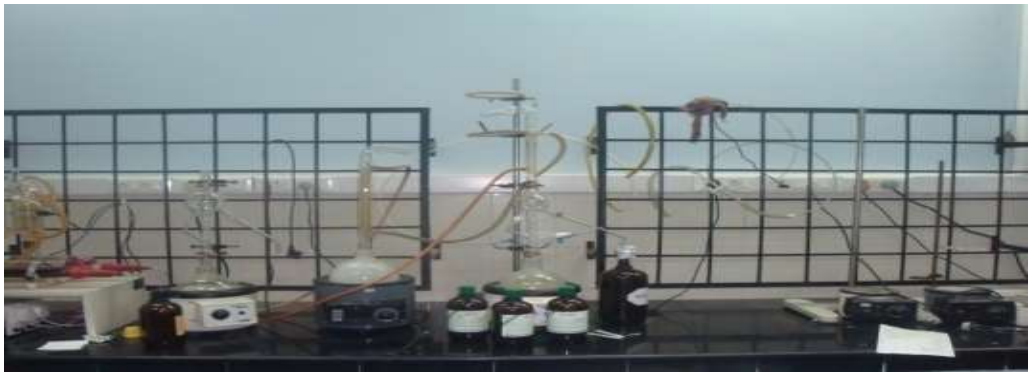
Summary of Selection Rules of Cycloadditions

Thermal 4n+2

Photochemical 4n

	2	4	6	8	10
2	P	T	P	T	P
4	T	P	T	P	T
6	P	T	P	T	P
8	T	P	T	P	T
10	P	T	P	T	P

Thank You



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