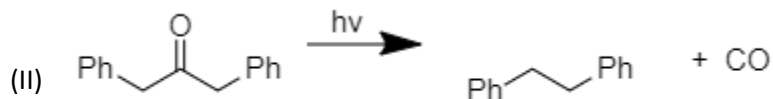
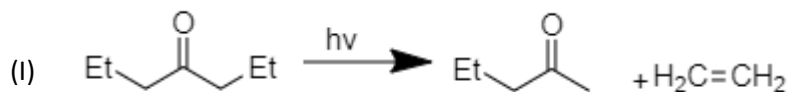


# Important Questions On Diels Alder Reaction



## Important Questions on Diels-Alder Reaction

1. Match the following starting compounds I and II with the products P to Q:



P-Diels-Alder reaction

Q- Norrish Type-I reaction

R-Norrish Type-II reaction

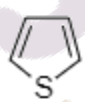
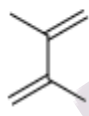
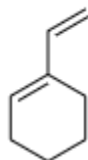
A. I-R, II-Q

B. I-P, II-R

C. I-P, II-Q

D. I-Q, II-R

2. Which of the following compounds will undergo Diels-alder reaction.



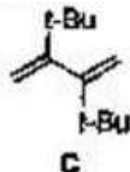
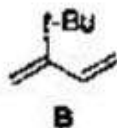
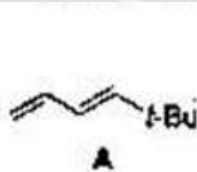
A. a, b, c

B. c and d

C. d and e

D. a, c, d and e

3. The order of reactivity for the following dienes towards Diels-Alder reaction is?



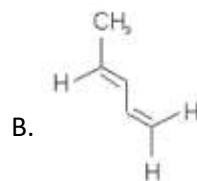
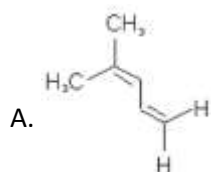
A. B > A > C

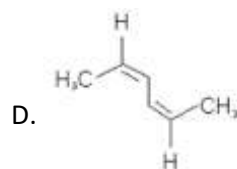
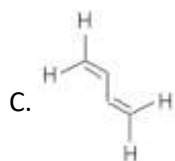
B. A > C > B

C. B > C > A

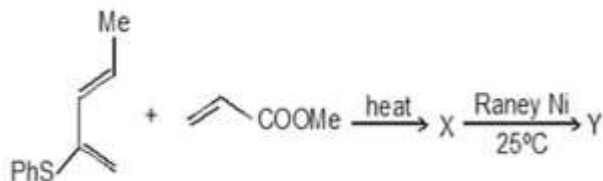
D. C > B > A

4. Which of the following will react most slowly with tetracyanoethylene in Diels-Alder reaction?



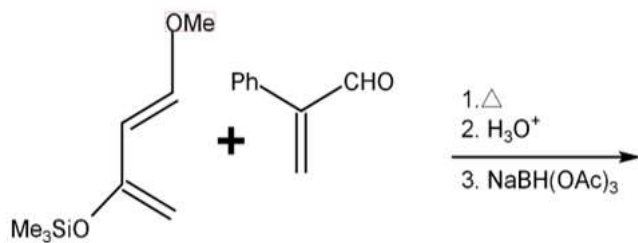


5. For the sequence given below, predict the major products X and Y.



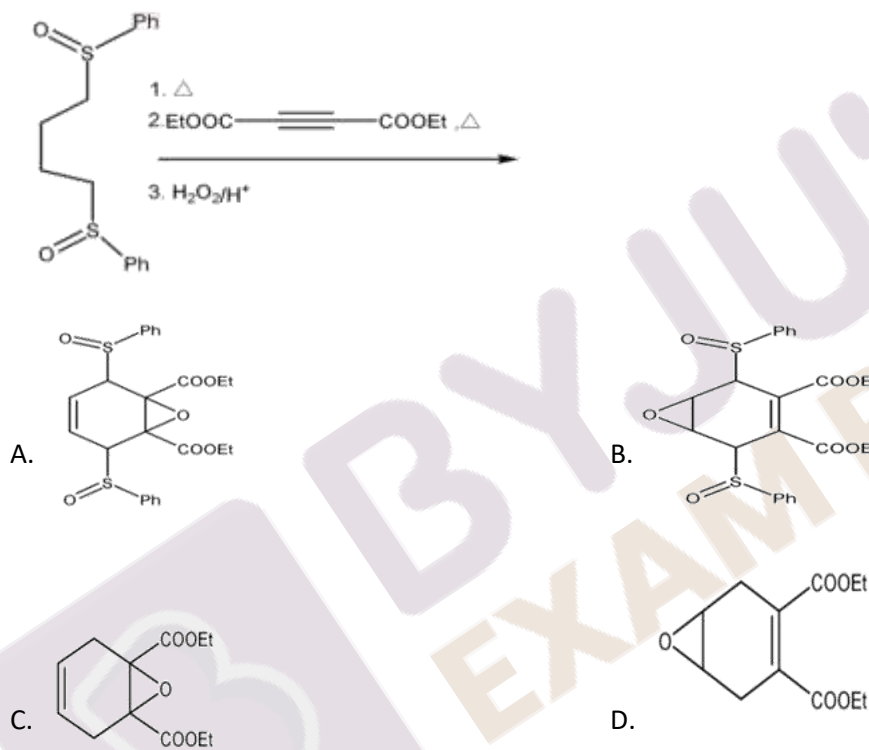
- A.
- B.
- C.
- D.

6. The major product formed in the following reaction is?

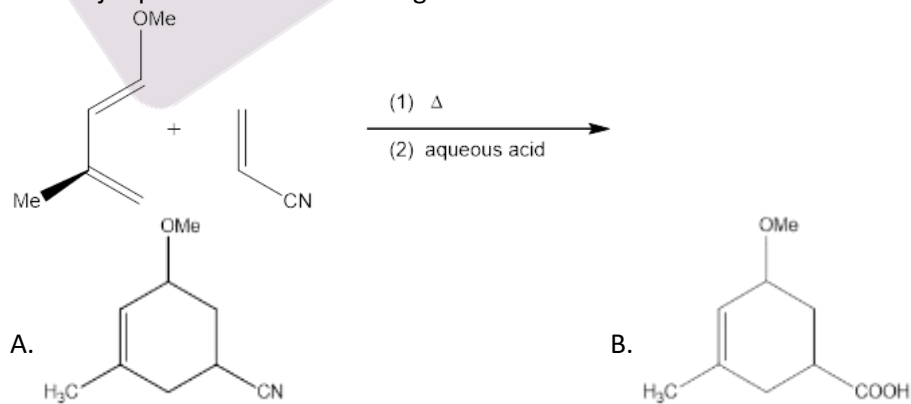


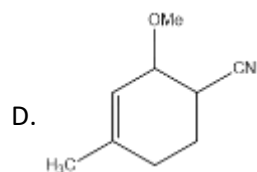
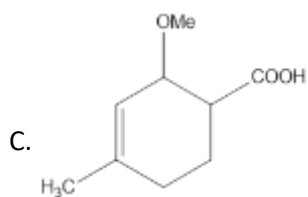


7. The major product formed in the following reaction is?

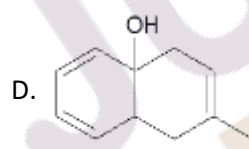
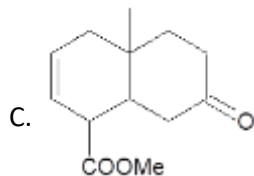
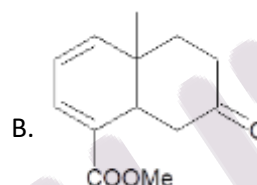
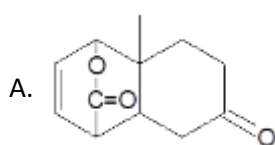
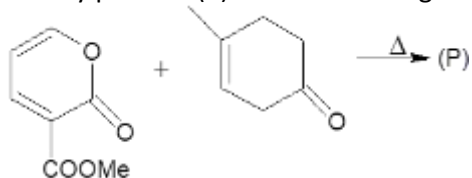


8. The major product of the following reaction is?

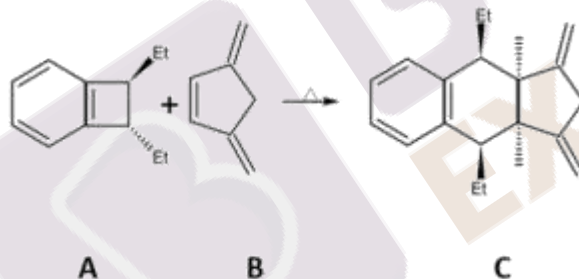




9. Identify product (P) of the reaction given below:



10. The reaction between A and B to give C proceeds via?



- 4 $\pi$ -disrotatory opening of A followed by endo Diels-Alder cycloaddition.
- 4 $\pi$ -conrotatory opening of A followed by endo Diels-Alder cycloaddition.
- 4 $\pi$ -disrotatory opening of A followed by exo Diels-Alder cycloaddition.
- 4 $\pi$ -conrotatory opening of A followed by exo Diels-Alder cycloaddition.

## Answers

- |      |      |       |      |      |      |      |
|------|------|-------|------|------|------|------|
| 1. A | 2. B | 3. A  | 4. D | 5. A | 6. A | 7. D |
| 8. C | 9. C | 10. B |      |      |      |      |

## Solutions

### Solution 01:

**Norrish Type I Cleavage:** A reaction originating from the carbonyl  $n, \pi^*$  state and proceeding through the homolytic cleavage of the carbonyl alkyl groups (i.e.,  $\alpha$ -bond as the primary photochemical process).

**Norrish Type II Cleavage:** A reaction originating from the carbonyl  $n, \pi^*$  state and proceeding through a six-centered fragmentation initiated by  $\gamma$ -hydrogen abstraction. The product of the fragmentation is an olefin and an enol which tautomerizes to the carbonyl compound.

### Solution 02:

Cis-dienes are required for the Diels-alder reaction. So, compounds (a) and (b) will not undergo Diels-alder reaction as they both are trans-alkene.

In the case of heterocyclic compounds, the aromaticity is inversely proportional to the diene character. Since thiophene compound (e) has more aromatic than furan and substituted pyrrole and therefore, it has the least diene character. So, it will not undergo a Diels-alder reaction.

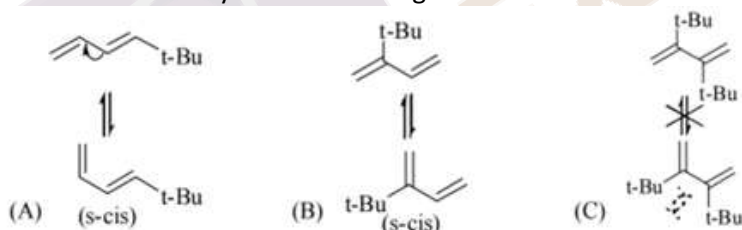
Compounds (c) and (d) are less aromatic in nature as the lone pairs on oxygen and nitrogen are not participating in the delocalization with the ring and therefore, have more diene character. Hence, compounds (c) and (d) will undergo a Diels-alder reaction.

### Solution 03:

**Diels – Alder Reaction:** It is a conjugate addition of conjugated diene with a dienophile.

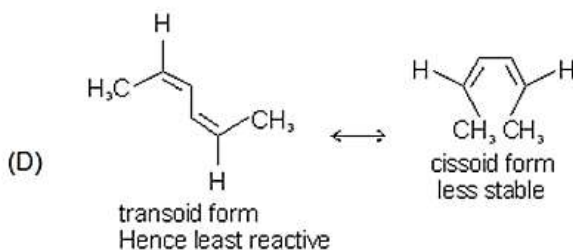
In Diels-Alder reaction the diene must be capable of achieving s-cis conformation.

The order of reactivity of the following dienes towards Diels-Alder reaction is  $B > A > C$



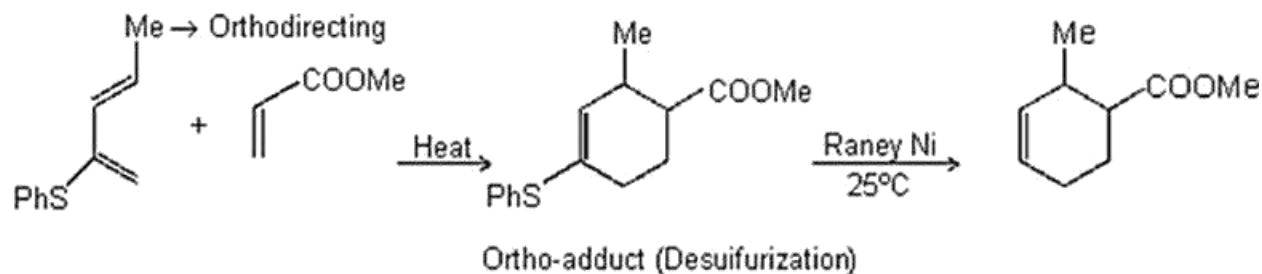
Due to two bulky tert. butyl groups on butadiene, it cannot achieve (s-cis) conformation. Hence diene C will be the least reactive. While in the case of A and B, B is more reactive towards Diels-alder reaction because there is no crowding at the reaction centre.

### Solution 04:



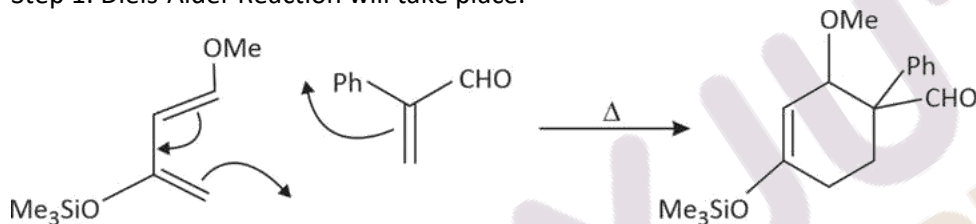
**Solution 05:**

Diels-Alder reactions are highly ortho/para selective, and these depend on the position of the electron-donating group on dienes. Raney Ni-removes sulfur atoms which is also known as desulfurization.

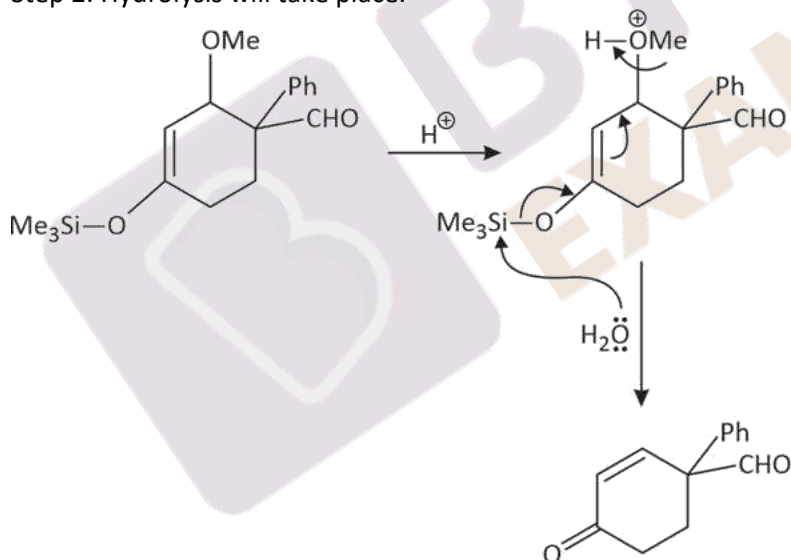


**Solution 06:**

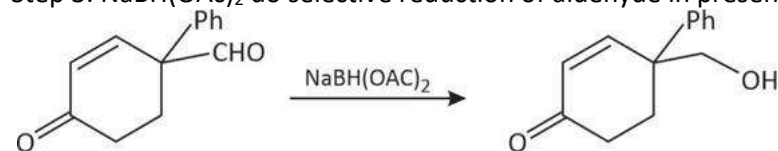
Step 1: Diels-Alder Reaction will take place.



Step 2: Hydrolysis will take place.



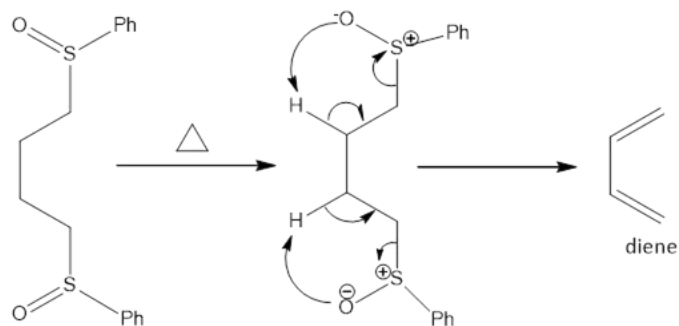
Step 3: NaBH(OAc)<sub>2</sub> do selective reduction of aldehyde in presence of Ketone.



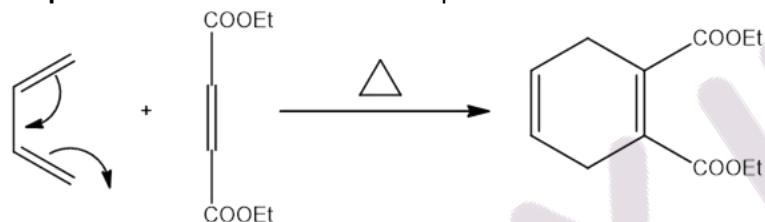
Correct answer is A.

**Solution 07:**

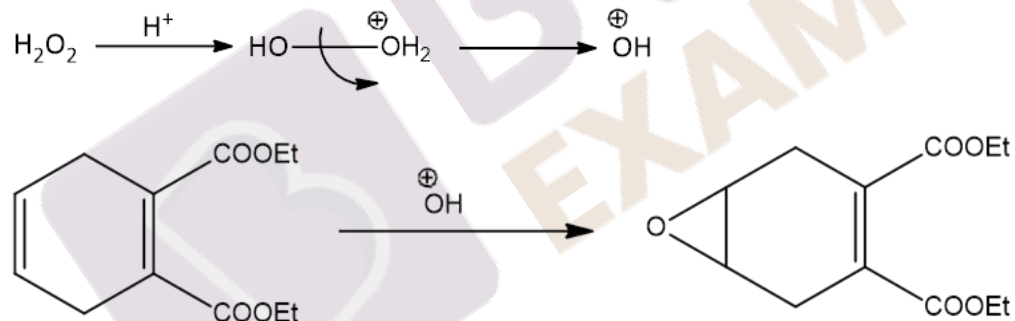
**Step-1:** Heating the sulfoxides results in the elimination reaction and the formation of diene will take place.



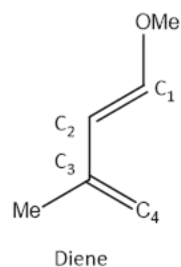
**Step-2** Diels Alder reaction will take place.



**Step-3** Formation of epoxide at more electron-dense alkene will take place.



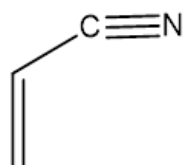
**Solution 08:**



In this, C<sub>4</sub> carbon has a maximum  $\delta$ -charge.

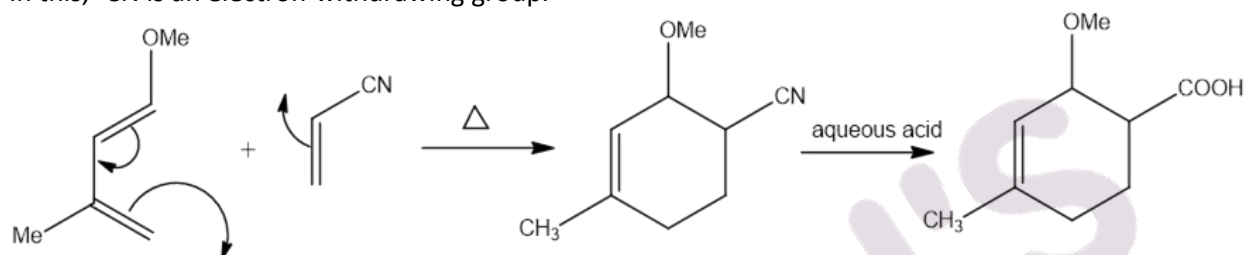
-OMe and -Me both are electron-donating groups but -OMe is better electron donating than Me.





Dienophile

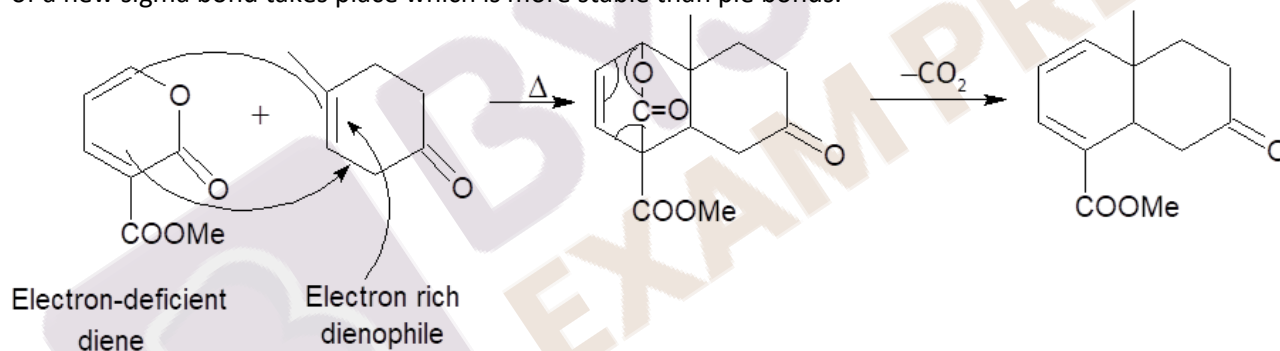
In this, -CN is an electron-withdrawing group.



This is a [4 + 2] Diels Alder Reaction.

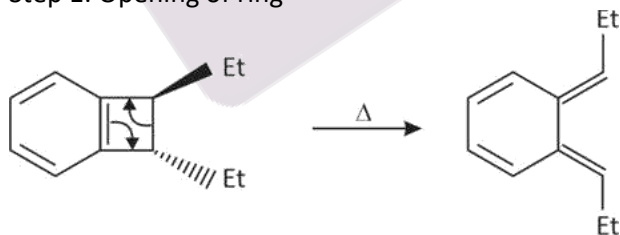
#### Solution 09:

The given reaction is a Diels-Alder reaction which is a (4+2) cycloaddition reaction. In this, the formation of a new sigma bond takes place which is more stable than pi bonds.



#### Solution 10:

Step 1: Opening of ring



$4n\pi$  electrons are involved and under thermal conditions, it will undergo a con-rotatory opening.

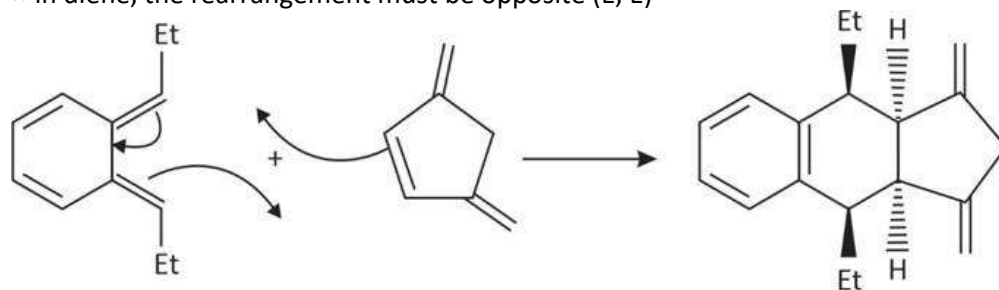
Applying ODC rule

Con rotatory + trans product

O      D      C

O      C      T

∴ in diene, the rearrangement must be opposite (E, E)



It will undergo endo-Diels Alder cycloaddition because of stability gained by bonding interactions.  
The correct answer is B.

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