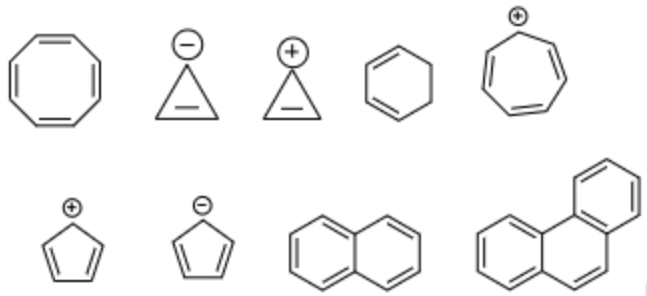
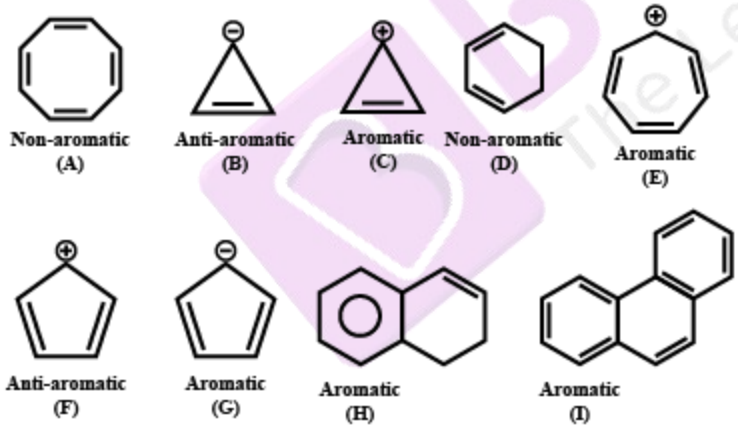
JEE Advanced Previous Year Questions on Aromatic Compounds

Question 1. Among the following, the number of aromatic compounds is:



Solution: (5)

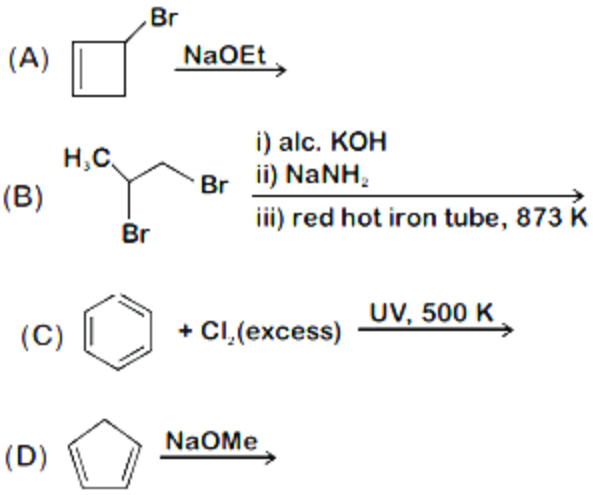


According to Huckel's rule, there are only 5 aromatic compounds.

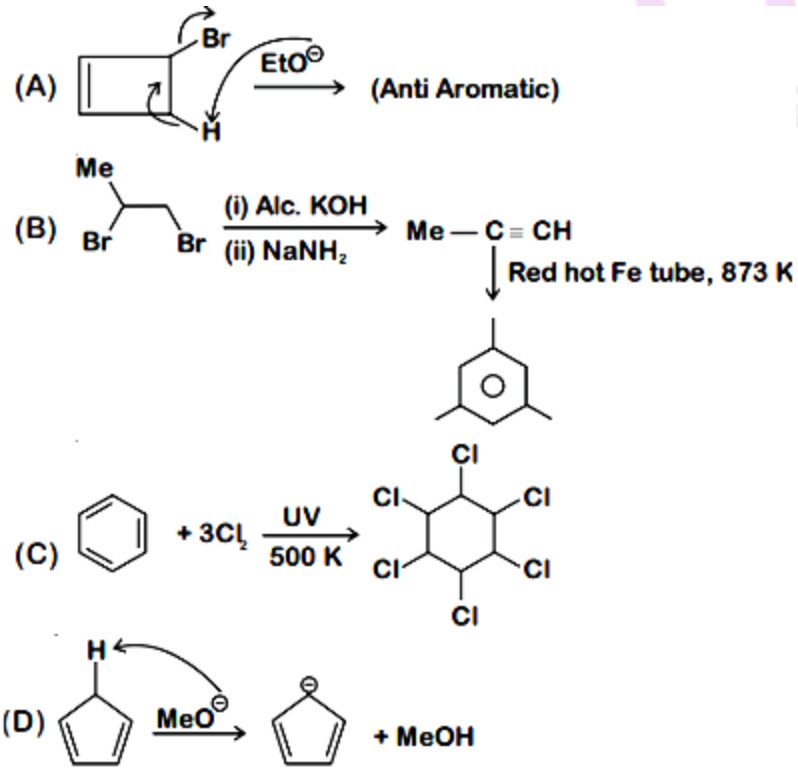
Cyclopropenyl anion, cyclooctatetraene and cyclopentadienyl cation are antiaromatic.

Cyclohexa-1, 3-diene is a non-aromatic compound.

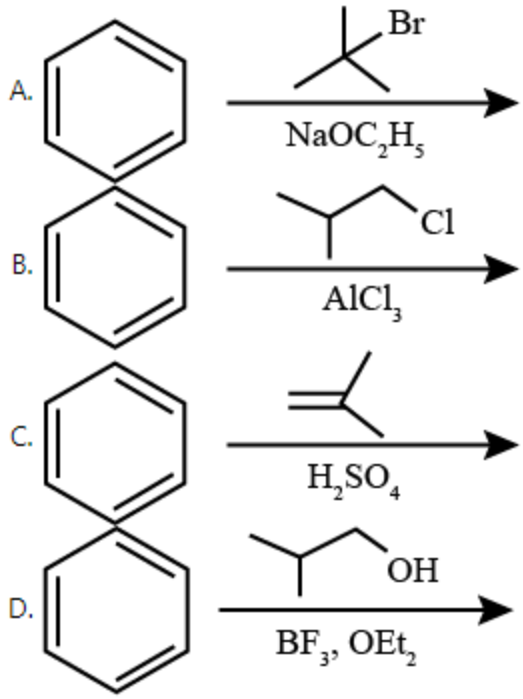
Question 2. Choose the correct option that gives an aromatic compound as the major product.



Solution: (B and D)

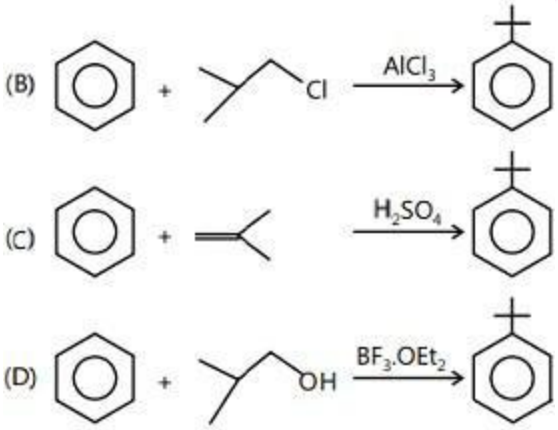


Question 3. Among the following, reaction(s) which give(s) tert-butyl benzene as the major product is/are:

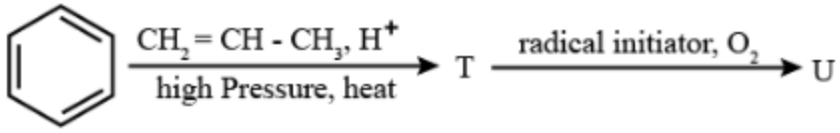


Solution: (B, C and D)

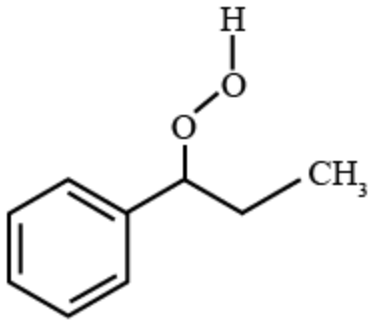
In option A an elimination reaction occurs therefore it will not give tert-butyl benzene as the major product.



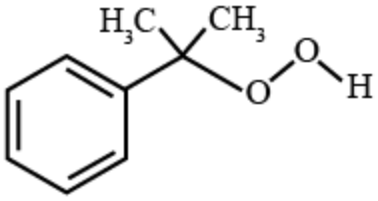
Question 4. The major product U in the following reactions is:



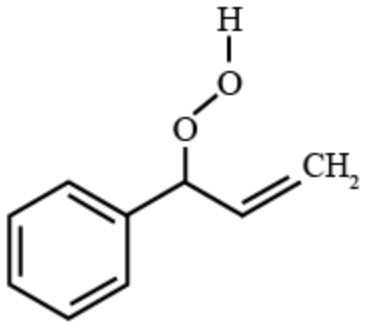
A.



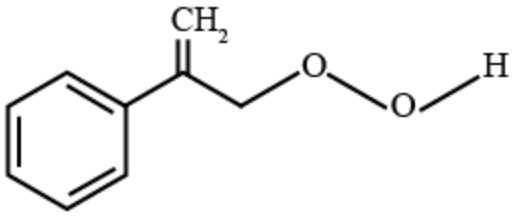
B.



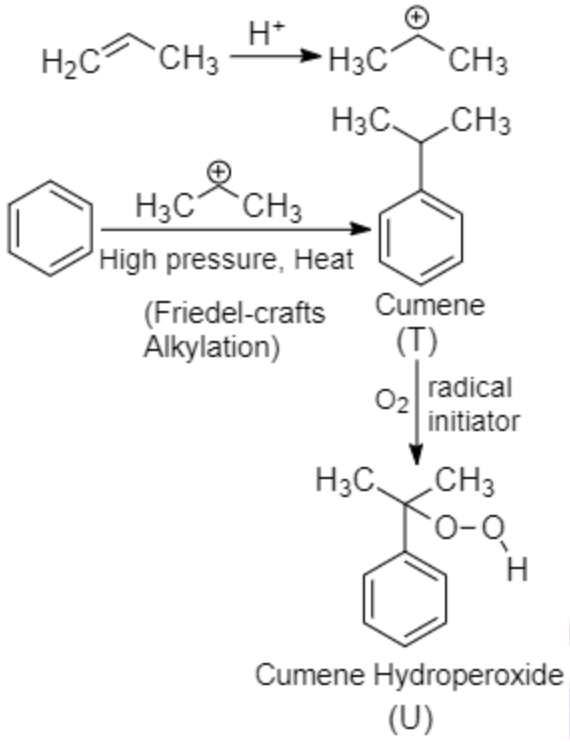
C.



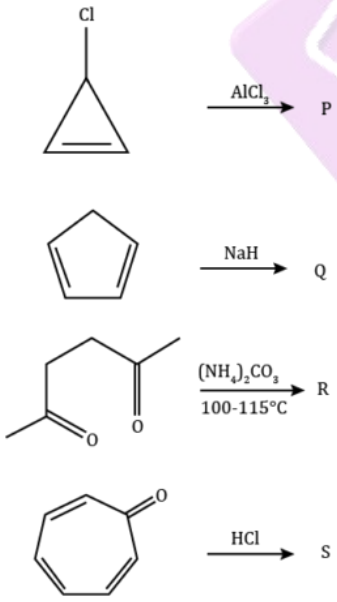
D.



Solution: (B)



Question 5. Among P, Q, R and S the aromatic compound(s) is/are:



A. P

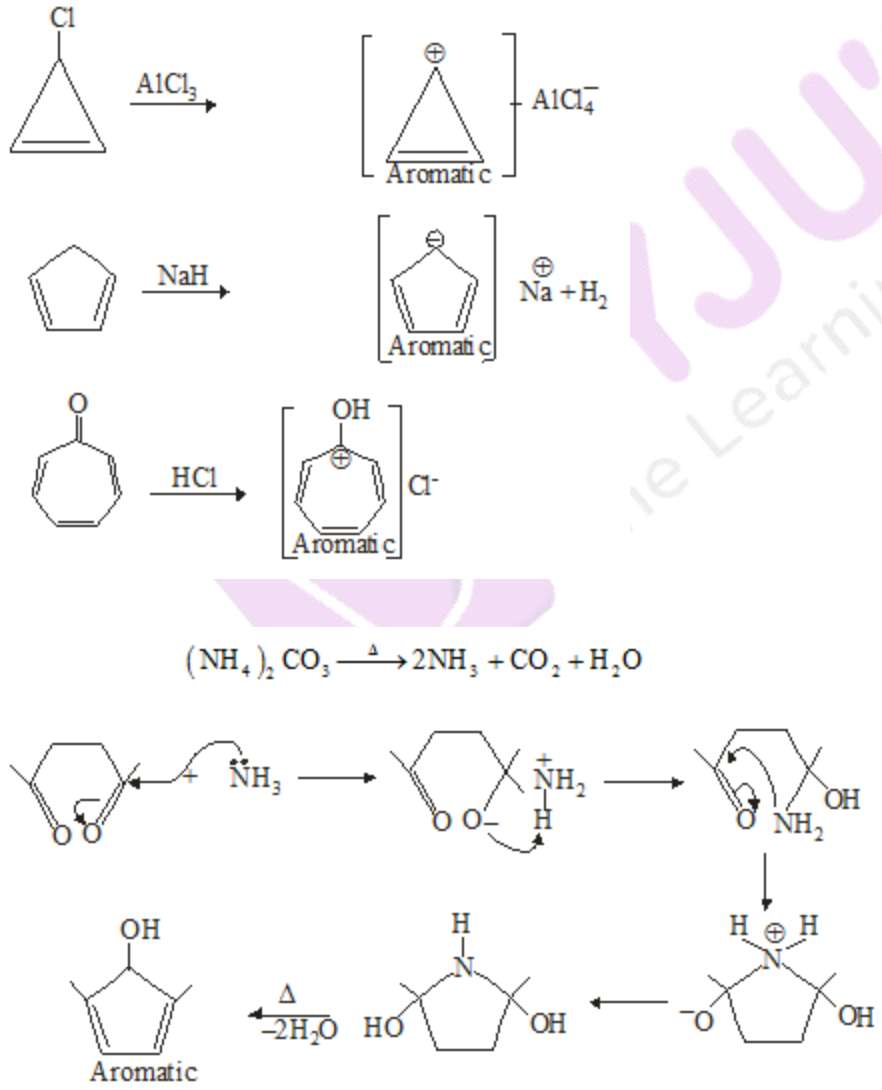
B. Q

C. R

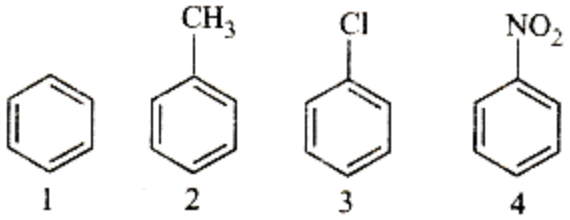
D. S

Solution: (All of them)

All the products formed in the above reactions obey Huckel's rule. Hence all the products formed are aromatic.



Question 6. Identify the correct order of reactivity in electrophilic substitution reaction of the following:



A. 1 > 2 > 3 > 4

B. 4 > 3 > 2 > 1

C. 2 > 1 > 3 > 4

D. 2 > 3 > 1 > 4

Solution: (C)

Electron donating group (EDG) increases the reactivity of electrophilic substitution reaction and electron-withdrawing group (EWG) decreases it.

(2) Ph − CH_3(+I and H.C effect) > (1) Benzene > (3) PhCl [−I effect of (Cl) group]> $PhNO_2$ [−I and −R effect of (−NO_2) group]

So the correct order is 2 > 1 > 3 > 4 .

Question 7. An aromatic molecule will have:

A. have 4n π electrons

B. have (4n + 2)π electrons

C. be planar

D. be cyclic

Solution: (B, C and D)

An aromatic molecule will have:

(B) (4n + 2)π electrons (by Huckel's rule)

(C) Planar structure (due to resonance), and

(D) Cyclic structure (due to the presence of sp^2 hybrid carbon atoms)

Question 8. Among the following statements on the nitration of aromatic compounds, the false one is:

A. The rate of nitration of benzene is almost the same as that of hexadeuterobenzene

B. The rate of nitration of toluene is greater than that of benzene

C. The rate of nitration of benzene is greater than that of hexadeuterobenzene

D. Nitration is an electrophilic substitution reaction

Solution: (C)

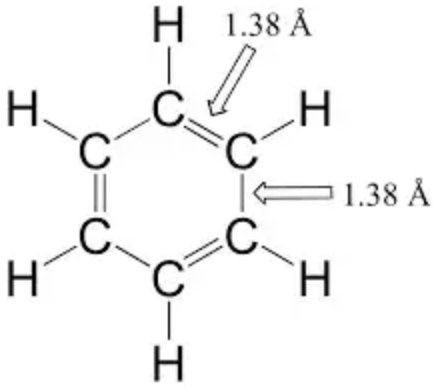
Hexadeuterobenzene is an isotope of benzene where all hydrogen atoms are replaced by deuterium.

In the nitration of benzene mechanism, nitronium ion is formed by nitric acid.

The removing of hydrogen doesn't take participate in the rate-determining step so the kinetic isotope effect is absent.

The rate of nitration of Deuterated benzene is the same as that of the benzene when the same sets of nitrating agent are used in both cases.

Question 9. The bond order of individual carbon-carbon bonds in benzene is:



benzene

A. one

B. two

C. between one and two

D. one and two alternately

Solution: (C)

The bond order of individual carbon-carbon bonds in benzene is between one and two. It is due to the resonance structure of C_6H_6. In the benzene molecule, carbon atoms form a ring with alternating single and double bonds in between each of them. Each carbon atom forms one bond with one carbon atom and one bond with another. The bonding electrons are delocalized over the entire molecule. Thus, benzene is a resonance hybrid of two equivalent structures, and the single and double bonds oscillate from one position to the other.

Benzene is a resonance hybrid of two resonating structures. Bond order can be calculated as:

Bond Order = Number of Resonating bonds / Number of resonating structures = 3 / 2 = 1.5

The correct answer is between one and two.

Question 10. Toluene, when treated with Br_2 / Fe, gives p-bromotoluene as the major product because the CH_3 group

A. is para-directing

B. is meta-directing

C. activates the ring by hyperconjugation

D. deactivates the ring

Solution: (A and C)

-CH_3 in toluene is a para directing group.It activates the ring by both inductive and hyperconjugation effects.