

Alcohols, Phenols & Ethers - 10

Properties of Phenols - 1

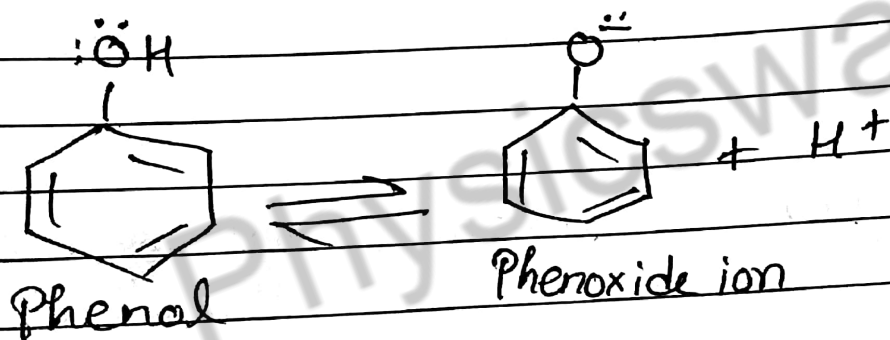
Acidic Nature of Phenols

Acidic Strength ($K_a \uparrow$ OR $pK_a \downarrow$)

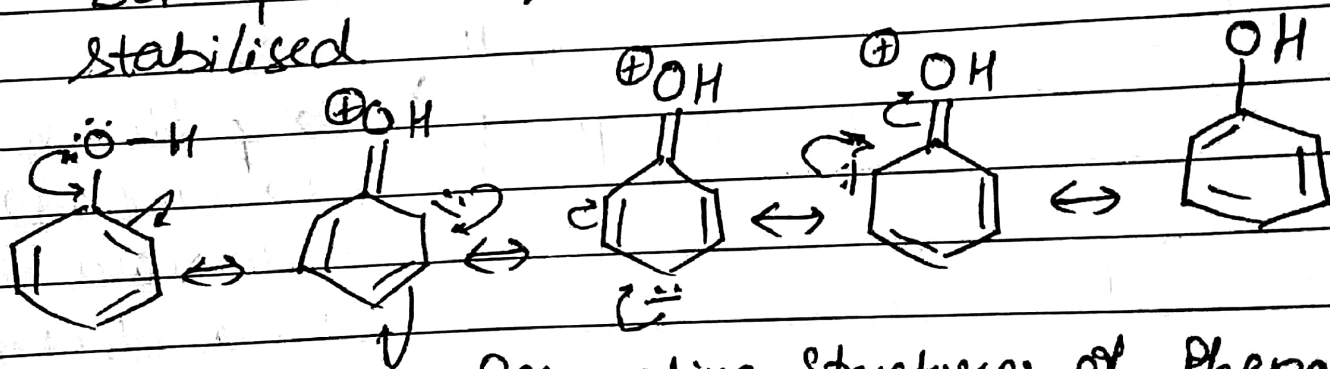
Carboxylic Acid > Phenols > water > Alcohols

K_a : 10^{-5} 10^{-10} 10^{-14} 10^{-18}

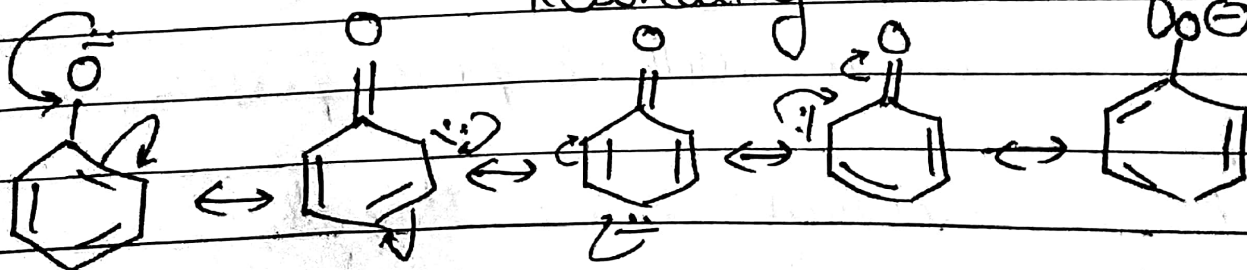
Q) Why Phenol is Acidic? OR Why Phenol loses H^+ ion even when it is Resonance stabilised?



Both phenol & phenoxide ion are Resonance stabilised



Resonating Structures of Phenol



Resonating Structures of Phenoxide ion

Both Phenol & phenoxide have 5 Resonating Structures each.

Stability \propto

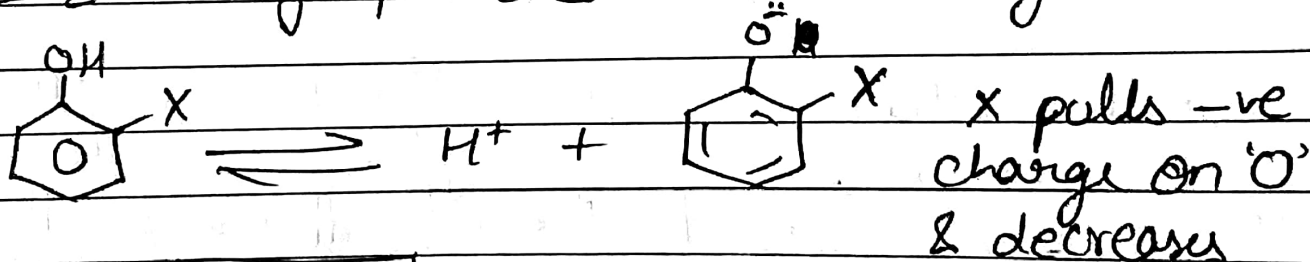
- ① NO. of Resonating structures
- ② Neutral Resonating structures
- ③ delocalised Resonating structures
- ④ charge separation in Resonating structures

Phenoxide ion	>	Phenol	(Stable)
charge delocalisation		charge separation	

Effect of Substituents on Acidic strength of Phenol:-

(EWG)

① $-I$ & $-M$ group increases Acidic strength



Note: $-M > -I$

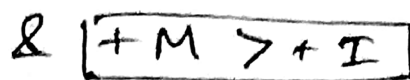
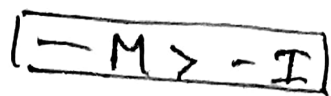
- This effect is more at ortho & para position.

(EDG)

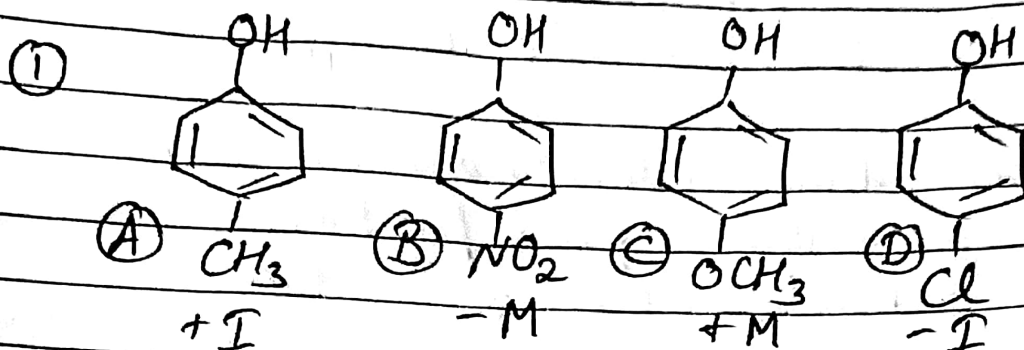
② $+I$ & $+M$ group decreases Acidic strength



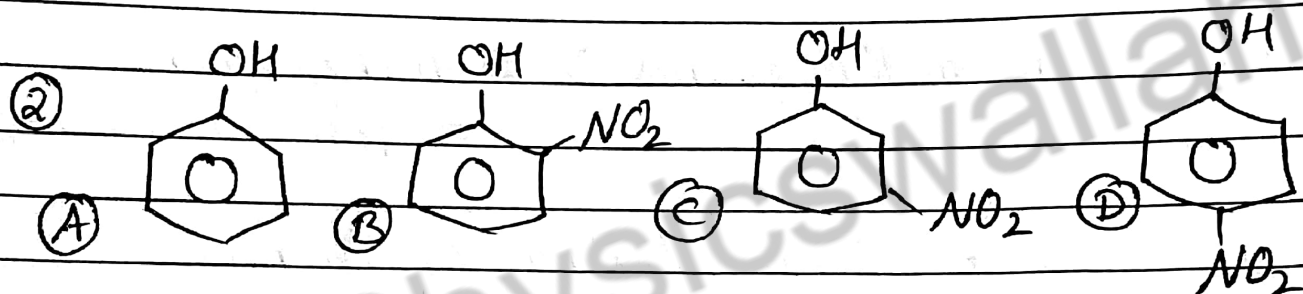
Effect is more at ortho & para positions



Arrange in order of Acidic Strength



$B > D > A > C$

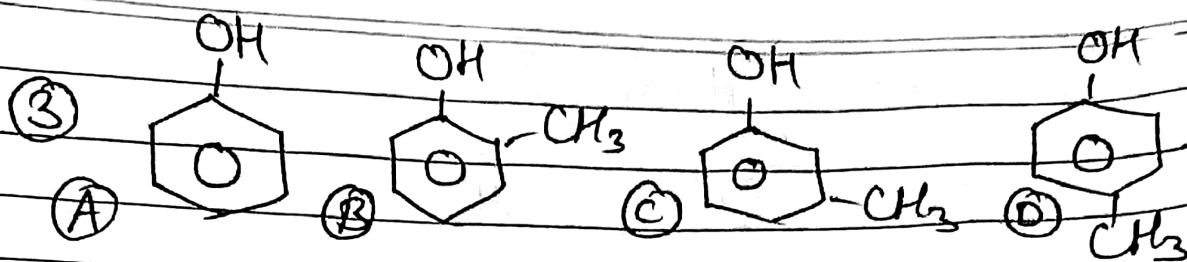


-M effect \rightarrow More at ortho & para

In ortho, there are chances of H-bonding
so less chances of releasing H^+ as compared to
para

p-nitro phenol $>$ o-nitro phenol $>$ m-nitro phenol
 $>$ phenol

$D > B > C > A$



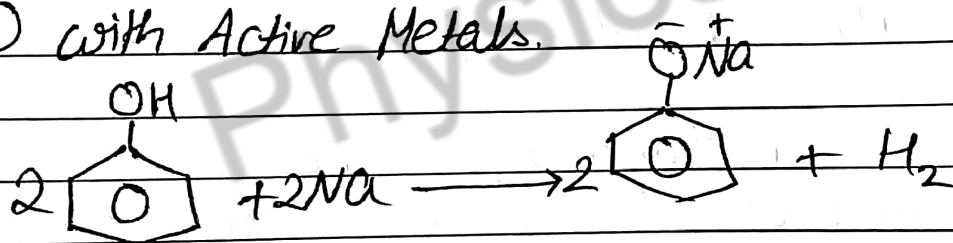
+I & hyperconjugation: - (decreases Acidic strength)
 Effect more at ortho & para position
 but no H-bonding at ortho this time



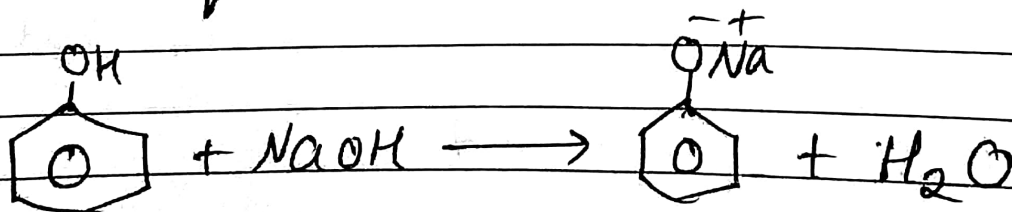
phenol > m-methyl phenol > o-methyl phenol
 \approx p-methyl phenol

Reactions due to Acidic Nature of Phenols

① with Active Metals.



② with aq. NaOH/KOH (alkalies)



→ This reaction is not shown by alcohols, as they are weaker Acid than water. Whereas phenols show this reaction as they are stronger Acids than water.

exception \rightarrow Methyl alcohol

Remember Acidic strength

Phenol $>$ methyl alcohol $>$ water $>$ All other Alcohols

③ Phenol do not react with metal carbonates & bicarbonates releasing CO_2 gas like carboxylic acids & other mineral acids do.