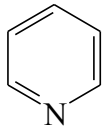
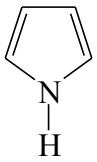
Marks 4

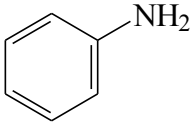
- Two of the following compounds are bases and two are not. Identify the two bases and explain, with the aid of diagrams, why they react with acids and why the other two compounds do not.



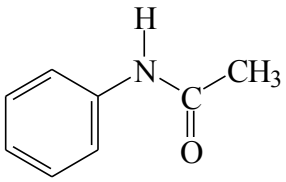
pyridine



pyrrole

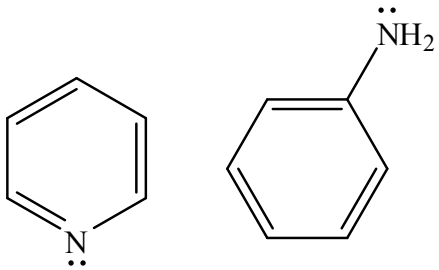


aniline



acetanilide

Pyridine and aniline are bases. Both compounds have lone pair of electrons on the N atom that can form bond to H^+ ion:



The nitrogen atom in pyridine is sp^2 hybridized and the ring is aromatic with 6 π electrons coming from two C=C and one C=N bond. The nitrogen uses 3 of its 5 valence electrons to make two C-N σ bonds and one C-N π bond. Its remaining 2 e^- are in a sp^2 hybrid directed away from the ring and are not involved in the π bonding. They are thus available to bond to a proton.

In pyrole, there are two C=C bonds contributing 4 π electrons. The nitrogen is involved in three σ bonds (two C-N and one N-H), leaving it with 2 more electrons. These are in a p-orbital and form part of the π ring. There are therefore 6 π electrons making pyrole aromatic. There is no lone pair on nitrogen and it is therefore not basic.

In the amide acetanilide, the 'lone pair' on nitrogen is actually delocalized over the neighbouring C-N and C=O bonds. This strengthens the C-N bond, making it between a single and a double bond, and, as the 'lone pair' is actually involved in bonding, making it non-basic. This resonance stabilization is important in making the amide C-N bond strong in proteins.