

Chemguide – answers

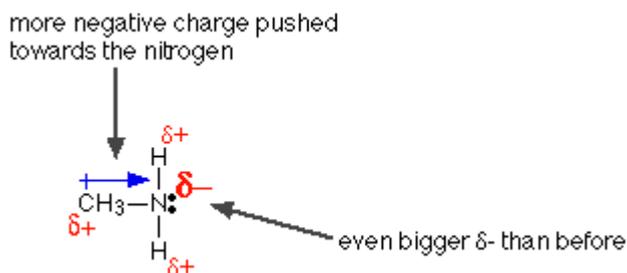
ORGANIC BASES

1. a) A base is a substance that combines with hydrogen ions. The diagram shows a hydrogen ion from water being transferred to the lone pair on the nitrogen in ammonia.

Nitrogen is more electronegative than hydrogen, and attracts the bonding pairs in ammonia towards itself. That makes the nitrogen relatively negative. The combination of the lone pair and the extra negativity of the nitrogen makes it attractive to hydrogen ions.

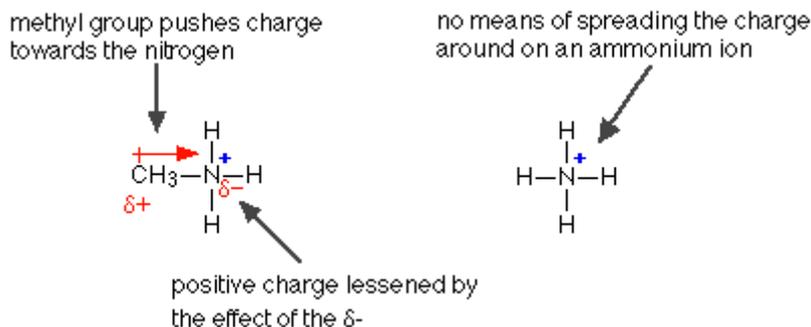
b) A weak base is one which doesn't successfully hang on to any hydrogen ion which it has picked up. The diagram shows that the reaction is reversible, and that the ammonium ion loses the hydrogen again. In this case, the position of equilibrium lies well to the left. Typically, at any one time, about 99% of the ammonia exists as unreacted ammonia rather than ammonium ions.

2. Alkyl groups like methyl tend to “push” electrons away from themselves. That makes the nitrogen even more negative than it is in ammonia.



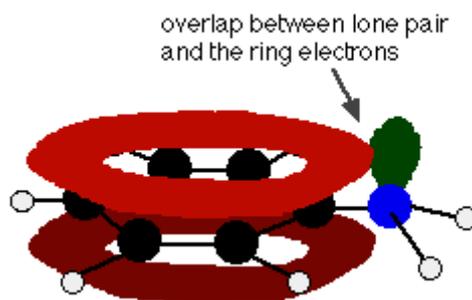
That makes the lone pair on the nitrogen more attractive towards hydrogen ions.

The ion formed is also made more stable because the positive charge is spread around more by this same “electron-pushing” effect.

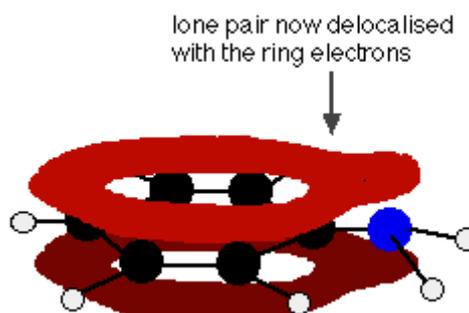


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3. The lone pair on the nitrogen in phenylamine overlaps with the electrons in the benzene ring



... and becomes delocalised:



The nitrogen is the most electronegative element present, and so the area around the nitrogen will still be the most negative part of the molecule. That means that phenylamine can still pick up a hydrogen ion, and so is still basic. But the delocalised lone pair is nothing like as effective as it would be if it was entirely concentrated around the nitrogen atom.

(You could also mention that in order for a hydrogen ion to attach to phenylamine, the delocalisation has to be broken, and this costs energy. Examiners are more likely just to want a version of the explanation above – but check the mark schemes for any past papers you have available to find out what yours want.)