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Organic Chemistry: Current Research

Editorial

Editorial on Resonance and Acid-Base Chemistry

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EDITORIAL

Resonance can cause this electron pair to delocalize, allowing the base to form a new bond with the proton. This delocalization improves the base's stability.... Since a weaker base has a stronger conjugate acid, a compound with a resonance stabilized conjugate base would be more acidic.

Now that we know how to measure an acid's or base's power, the next step is to understand the fundamental reasons why one compound is more acidic or basic than another. This is a significant step: we are applying our understanding of organic structure to a topic of organic reactivity for the first time. Many of the concepts we'll see for the first time here will apply in the book when we look at a variety of other organic reaction forms.

Periodic trends

First, we'll look at individual atoms and consider patterns correlated with an element's place on the periodic table. The basic organic compounds ethane, methylamine, and ethanol will serve as our first models, but the principles can be applied to more complex biomolecules with similar functionalities, such as the side chains of the amino acids alanine (alkane), lysine (amine), and serine (serine) (alcohol).

As a result, of the three conjugate bases, the methoxide anion is the most stable (lowest energy, least basic), while the ethyl carbanion anion is the least stable (highest energy, most basic). In contrast, ethanol is the strongest acid, while ethane is the lowest.

We can see a strong periodic pattern in acidity when travelling vertically within a given column of the periodic table. The halo acids and halides are the best example of this: basicity, including electronegativity, increases as we step up the column.

In order to make sense of this pattern, we'll look at the conjugate bases' stability once more. We would expect fluoride to be the least basic halogen ion because fluorine is the most electronegative halogen element.

It is, however, the least stable and most fundamental! In terms of basicity, it turns out that the size of the atom trumps its electronegativity when you pass vertically around the periodic table.

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