OXIDATION AND REDUCTION

OXIDATION OF 9-FLUORENOL
**DID YOU KNOW?**

Reduction-oxidation reactions, or redox reactions, have enormous importance in biological systems. For example, your cells oxidize glucose to CO$_2$ providing much of the energy you use!

Oxidation reactions are particularly useful tools for synthetic chemists. They functionalize otherwise unreactive positions on molecules adding new chemical possibilities to explore!

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**THE REACTION**

\[ \text{OH} \quad \text{NaOCl} \quad \text{CH}_3\text{COOH} \quad \text{O} \]

Note: sodium hypochlorite and acetic acid form hypochlorous acid - the key oxidant in this rxn.

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**THE MECHANISM**

Lone pair electrons attack partial positive Cl in hypochlorous acid and hydroxide leaves. Then hydroxide electrons attack proton forming H$_2$O.

Carbon oxygen double bond forms; chloride ion leaves.

Water acts as a base attacking acidic proton.

Lone pair electrons attack Cl. Hydroxide leaves while simultaneously abstracting proton to form H$_2$O.
9-Fluorenol $^1$H NMR
(60 MHz, 2 scan, 22 seconds)

$^1$H NMR spectrum of 9-fluorenol in DMSO shows a group of signals at 7.2 - 8.0 ppm that arises from the aromatic protons. The -CH proton resonates at 5.5 ppm and the -OH proton resonates at 4.7 ppm.

Fluorenone $^1$H NMR
(60 MHz, 2 scan, 22 seconds)

Comparing fluorenone with 9-fluorenol, we see two fewer protons as a result of oxidation. Consequently, the -OH and -CH signals do not appear in the $^1$H NMR spectrum of fluorenone. The signals at 7.2 - 7.8 ppm arise from the aromatic protons.
REINFORCE KEY CONCEPTS

+ electronegativity  
+ oxidation state  
+ oxidizing agent

PRACTICE THE MECHANISM

\[
\text{Reaction: } 
\text{NaOCl}\rightarrow\text{CH}_3\text{COOH} 
\]

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