

Chapter 17

Understanding Organic Redox Reactions and Preparing for the ACS Exam

Key Concepts

When the net number of bonds to OXYGEN or a halogen INCREASE, and/or when the net number of bonds to hydrogen decrease, a molecule is said to be OXIDIZED. When the net number of bonds to oxygen (or a halogen) is REDUCED (and/or the number of bonds to hydrogen is increased), the substance is said to be REDUCED.

A recognizable pattern for many common oxidizing agents is that they have a significant number of oxygen atoms, and therefore, the central atom has a very positive oxidation number. (Examples include H_2CrO_4 , NaCr_2O_7 , KMnO_4 , OsO_4 , and HIO_4 .) When a large central atom (one with 5 or 6 shells) has a high oxidation number, it oxidizes an organic molecule to the next highest oxidation state. When the oxidizing agent contains a smaller central atom with a high oxidation number, it is more aggressive and so it moves a sample 2 oxidation levels.

What You Need To Learn, Understand, and Apply

1. How to determine when an organic reaction involves oxidation or reduction.
2. How to predict the outcomes of common organic reactions that cause reduction to occur, including those that use each of the following reactants: H_2 with Pt, Pd or Ni; Lindlar's reagent; Raney nickel; Na or Li with NH_3 ; NaBH_4 or LiAlH_4 ; and NH_2NH_2 with hydroxide.
3. How to predict the outcomes of common organic reactions that cause oxidation to occur, including those that use each of the following reactants: Chromium(VI) (such as $\text{Na}_2\text{Cr}_2\text{O}_7$, H_2CrO_4 , and PCC); Manganese(VII) (KMnO_4); I(VII) (HIO_4); Osmium(VIII) (OsO_4); and O_3 .
4. How to protect a functional group from oxidation while reacting another.
5. How to predict radical-based reactions of alkanes/alkyl groups.
6. How to work multi-step synthesis reactions.
7. How to prepare for the ACS Examination in Organic Chemistry.