

Reagents by Redox and Acid/Base Classes

Oxidizing Agents:

Free Radicals:

Cl[•], Br[•], I[•] (Cl[•] and Br[•] both add and abstract H)

Compounds with O-O bonds:

PhC(=O)OOC(=O)Ph, *t*BuOO*t*Bu (free radical initiators)

O₃, RCO₃H, H₂O₂, O₂

Halogen molecules and related species:

Cl₂, Br₂, I₂, Cl-OH, Br-OH (add to π bonds)

Metals in high valence states:

KMnO₄, Cr(VI) reagents, OsO₄, NaIO₄, MnO₂, Fe(III), Cu(II), Ag(I)

Reducing Agents:

Hydrogenation:

H₂/catalyst (transition metals, esp. Pd, Pt, Ni)

Metals:

K⁰, Na⁰, Li⁰, Mg⁰, Zn⁰

Hydride Donors:

B₂H₆, LiAlH₄, NaBH₄

Inorganic Reducing Agents:

Bisulfite (NaHSO₃), Hypophosphorous acid (H₃PO₂), Thiosulfate (Na₂S₂O₃)

Nucleophiles/Bases:

Anionic

Carbon Centered: RLi, RMgX, R₂CuLi, N≡C⁻

Nitrogen Centered: *i*Pr₂N⁻Li⁺, H₂N⁻M⁺, N₃⁻

Oxygen Centered: RO⁻, HO⁻, CH₃C(=O)O⁻

Sulfur Centered: RS⁻, N≡CS⁻

Halogens: Cl⁻, Br⁻, I⁻

Neutral

R₃N, H₃N, ROH, H₂O

Acids:

Mineral Acids:

HClO₄, H₂SO₄, HNO₃, HCl, HBr, HI, H₃PO₄

Strong Organic Acids:

RSO₃H, CF₃CO₂H

Carboxylic Acids:

RCO₂H

Weaker Organic Acids:

HCN, ROH

Basicity, nucleophilicity, and reducing power do tend to go together; electrons are given up in all three cases. Good nucleophiles like I⁻ and RS⁻ can give up one electron to an easily reduced compound as well as act as nucleophiles (making Y-C bonds). In the same vein, acidity and oxidizing power are related. Some strong acids like HClO₄, HNO₃, and H₂SO₄ can oxidize compounds as well as protonate them.