

HARD ACIDS / BASES

(small and highly charged)

(electrostatics dominant)

(ionic bonds)

High LUMO

Low HOMO

H⁺

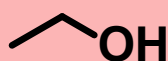
Li⁺, Na⁺, K⁺
Be²⁺, Mg²⁺, Ca²⁺
Al³⁺, Ga³⁺
Cr³⁺, Co³⁺, Fe³⁺
Si⁴⁺, Ti⁴⁺
Ce³⁺, Sn⁴⁺

R-OTs, R-OSO₃⁻

F⁻

H₂O, OH⁻

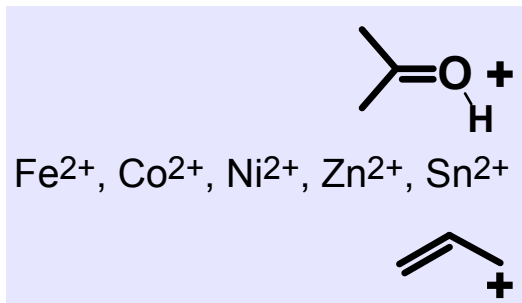
PO₄³⁻, SO₄²⁻, NO₃⁻

OH

Cl⁻

NH₂

“hard”
site

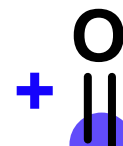


Br⁻

SO₃²⁻, NO₂⁻

N₃⁻

“hard”
site

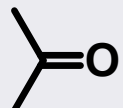


“soft”
site

Cu⁺, Ag⁺, Hg⁺
Pd²⁺, Cd²⁺, Pt²⁺, Hg²⁺
CH₃Hg⁺, BH₃, Zn²⁺, Sn²⁺

R-Cl

R-Br



R-I

X₂

Carbenes

Low LUMO

CN⁻

I⁻

RSH



Carbanions

High HOMO

“soft”
site

SOFT ACIDS / BASES

(large and minimally charged)

(orbital overlap dominant)

(covalent bonds)