Periodic Trends

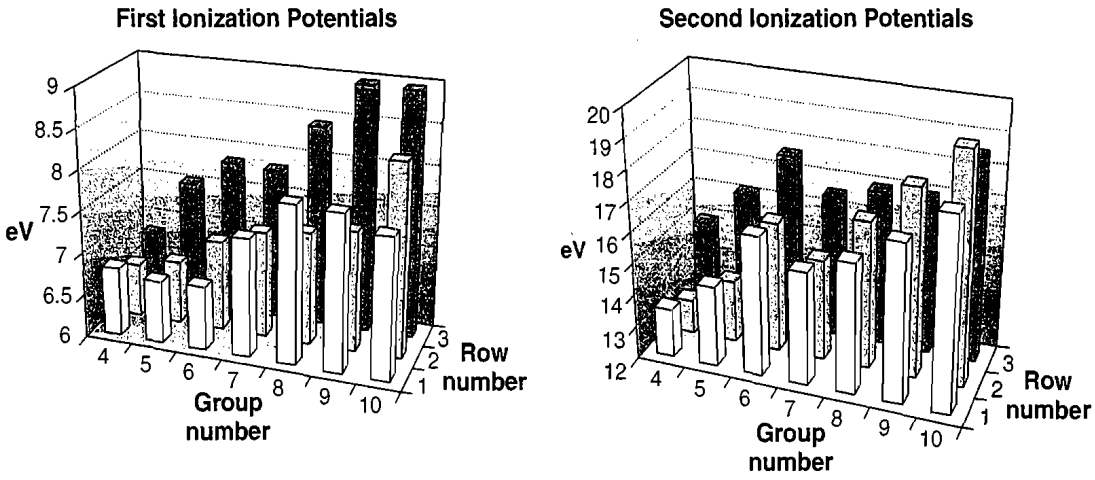

Figure 1.9.
Trends in ionization potentials for the transition metals in groups 4–10. Data from Douglas, B. E.; McDaniel, D. H.; Alexander, J. J. *Concepts and Models of Inorganic Chemistry*, 3rd ed.; Wiley: New York, 1994.

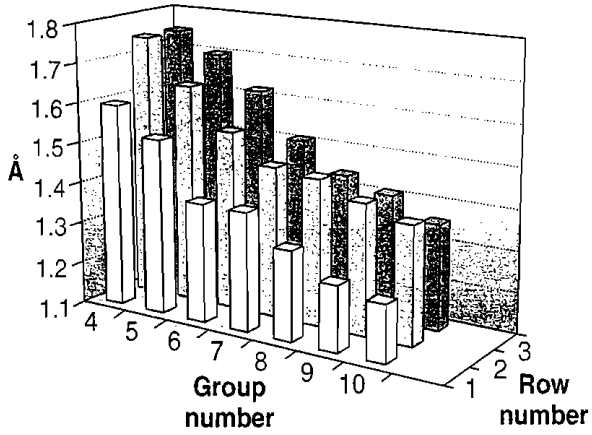

Figure 1.10.
Trends in covalent radii for the transition metals. Data from Cordero, B.; Gómez, V.; Platero-Prats, A. E.; Revés, M.; Echeverría, J.; Cremades, E.; Barragán, F.; Alvarez, S. *J. Chem. Soc., Dalton Trans*. **2008**, 2832.

HSAB Theory

TABLE 1.1 Hard and Soft Acids and Bases: Some Formation Constants[a]

Metal Ion (Acid)	Ligand (Base)			
	F^- (Hard)	Cl^-	Br^-	I^- (Soft)
H^+ (hard)	3	–7	–9	–9.5
Zn^{2+}	0.7	–0.2	–0.6	–1.3
Cu^{2+}	0.05	0.05	–0.03	–
Hg^{2+} (soft)	1.03	6.74	8.94	12.87

[a]The values are the negative logarithms of the equilibrium constant for $[M.aq]^{n+} + X^- \leftrightharpoons [MX.aq]^{(n-1)+}$ and show how H^+ and Zn^{2+} are hard acids, forming stronger complexes with F^- than with Cl^-, Br^-, or I^-. Cu^{2+} is a borderline case, and Hg^{2+} is a very soft acid, forming much stronger complexes with the more polarizable halide ions.