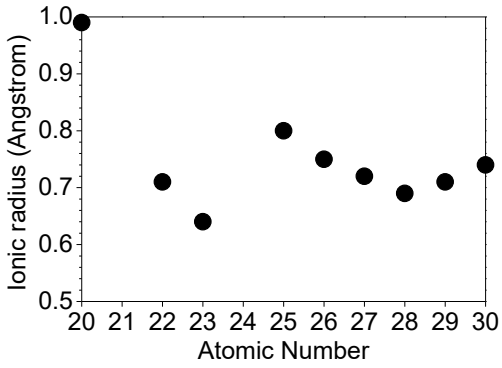
This set consists of 6 problems and the total points is 4.

8.63. (0.8 point) Based on the structures of their oxides, the following ionic radii (in angstroms) are estimated for the 12 ions of selected elements of the first transition-metal series: Ca^{2+} (0.99), Ti^{2+} (0.71), V^{2+} (0.64), Mn^{2+} (0.80), Fe^{2+} (0.75), Co^{2+} (0.72), Ni^{2+} (0.69), Cu^{2+} (0.71), Zn^{2+} (0.74). The oxides take the rock salt (NaCl) structure. Use their electronic configuration diagram to explain

a) Explain why V^{2+} and Ni^{2+} are relatively small comparing to their counterparts;

b) Explain why Mn^{2+} is relatively large.



hint:

8.66. (0.5 point) In the coordination compound $(NH_4)_2[Fe(OH_2)F_5]$, the Fe is octahedrally coordinated.

(a) Based on the fact that F^- is a weak-field ligand, predict whether this compound is diamagnetic or paramagnetic. If it is paramagnetic, tell how many unpaired electrons it has.

(b) By comparison with other complexes reviewed in this chapter, discuss the likely color of this compound.

8.68. (0.8 point) Compare the bond order, bond length and bond strength of C-O in a free CO molecule and in a $Ni(CO)_4$ molecule, Explain.

8.72. (0.6 point) The compound $WH_2(C_5H_5)_2$ acts as a base, but $TaH_3(C_5H_5)_2$ does not. Explain.

8.34 (0.9 pt) Mn, Fe, and Co in the +2 and +3 oxidation states all form hexaaquacomplexes in acidic aqueous solution. The reduction reactions of the three species are represented schematically below, where the water ligands are not shown for simplicity. It is an experimental fact from electrochemistry that Mn^{3+} and Co^{3+} are more easily reduced than Fe^{3+}; that is, they will more readily accept an electron. Based on the electron configurations of the ions involved, explain why Fe^{3+} is harder to reduce than Mn^{3+} and Co^{3+}.

$$Mn^{3+} + e \longrightarrow Mn^{2+}$$
$$Fe^{3+} + e \longrightarrow Fe^{2+}$$
$$Co^{3+} + e \longrightarrow Co^{2+}$$

8.71 (0.4 pt) What energy levels are occupied in a complex such as hexacarbonylchromium(0)? Are any electrons placed into antibonding orbitals that are derived from the chromium d orbitals?