CHEM 35
General Chemistry
Quiz #7

November 10, 2000

Name: **Largo, Key**

1. Atomic size *decreases* across a period, even though the number of electrons *increases*. Explain why this trend is observed.

As you go across a period, the atomic number (Z) increases indicating similar increases in the number of protons and electrons. The added electrons, however, experience an increased electrostatic attraction due to the increased positive charge, as the degree of shielding remains constant. Thus, Z_{eff} *increases* as you go across a period, resulting in a greater attractive force on the valence electrons, pulling them in closer to the nucleus. Thus, atomic radii *decrease* as you go across a period.

2. Titanium (Z = 22) is a transition metal. What is the ground state electron configuration for the Ti^{2+} ion?

For the neutral Ti atom:

$$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^2$$

We remove electrons, however, from the ***4s*** orbital first, giving the following for Ti^{2+}:

$$1s^2 2s^2 2p^6 3s^2 3p^6 3d^2$$

3. O^{2-} and Na^+ and Al^{3+} are all isoelectronic with Ne. Arrange these four isoelectronic species in order of increasing radius. Give a very brief justification for your answer.

Atomic number increases as we go from O^{2-} to Ne to Na^+ to Al^{3+}, so Z_{eff} increases (number of electrons are same for all, so shielding is the same). Thus, species radius will *decrease* with increasing Z_{eff}.

In order of increasing radius: ***Al^{3+} < Na^+ < Ne < O^{2-}***