Chemistry 141 Name

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Quiz 9 (40 points) Thurday, April 19, 2012

1. (3 points) What are the possible values of the principle quantum number n? What does the principle quantum number determine?

The principal quantum number, n, can have integer values from 1 to infinity. The principle quantum number tells the energy level of the electron.

1. (3 points) What are the possible values of the magnetic quantum number ml? What does the magnetic quantum number determine?

The magnetic quantum number, ml, has values of l to –l including zero. It tells the orientation of each of the orbitals in a specific sublevel.

1. (3 points) Which electron is, on average, further from the nucleus: an electron in a 3p orbital or an electron in a 4p orbital?

A 4p orbital is farther from the nucleus on average.

1. (3 points) Does the transition from n =3 to n =5 in the hydrogen atom correspond to an emission or absorption of energy?

Energy must be put into the system to promote an electron from the n =3 to the n =5 level, thus this is an absorbtion of energy.

1. (3 points) Write the complete electron configuration for an atom of sulfur.

S 1s2 2s2 2p6 3s2 3p4

1. (3 points) Write the shorthand configuration for an atom of iridium.

Ir [Xe] 6s2 5d7 4f14

1. (3 points) Write the shorthand electron configuration for a manganese (II) ion.

Mn2+ [Ar] 3d5

Remember the 4s electrons are lost first!

1. (5 points) Write the electron configuration for Ni from the periodic table. Given your knowledge regarding the filling of orbitals, predict whether or not this element has an anomalous configuration. If so, what configuration would you predict?

Ni 1s2 2s2 2p6 3s2 3p6 4s2 3d8

Would predict 1s2 2s2 2p6 3s2 3p6 3d10 because it would fill the 3d sublevel and filled sublevels give greater stability.

1. (3 points) How many valence electrons are in an atom of tellurium? Draw a lewis electron dot structure for tellurium.

There are 6 valence electrons in tellurium.

1. (4 points) Both vanadium and the vanadium(III) ion are paramagnetic. Use electron configurations to explain why this is so.

V [Ar] 4s2 3d3

V3+ [Ar] 3d3 because 4s electrons are lost 1st, the remaining electrons are in the 3d sublevel where they will each occupy different orbitals. If the 3d electrons were lost 1st it would be diamagnetic.

1. (3 points) What is the general trend in ionization energy as you move across a row in the periodic table? Explain.

Ionization energy increases as you move across the periodic table to the right. This is because the effective nuclear charge is increasing which means that the electrons are held more tightly.

1. (4 points) Arrange this series in order of increasing atomic radius: Se2–, Sr2+, Br–, Rb+, Kr. Explain your reasoning.

Because these species are all isoelectronic, meaning they have the same electron configuration, the species with more protons (and higher positive charge) will be smaller.

Thus Sr2+<Rb+<Kr<Br–<Se2–