Physics 402
Spring 2019
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Discussion Worksheet for March 13, 2019

1. Using Hund's rules, reported below for completeness, find the ground state electron configuration for the following elements (only the non-completely filled shells are reported):

a. Be, Mg, Ca: $(ns)^2$ (n=2, 3, 4, respectively)
b. Ne, Ar, Kr: $(ns)^2(np)^6$ (n=2, 3, 4, respectively)
c. F, Cl, Br: $(ns)^2(np)^5$ (n=2, 3, 4 respectively)
d. O, S, Se: $(ns)^2(np)^4$ (n=2, 3, 4 respectively)
e. N, P, As: $(ns)^2(np)^3$ (n=2, 3, 4 respectively)
f. V: $(4s)^2(3d)^3$
g. Cr: $(4s)^1(3d)^5$ (careful: *s* orbital not filled!)
h. Mn: $(4s)^2(3d)^5$
i. Fe: $(4s)^2(3d)^6$

Hund's rules:

I. The state with the highest total spin will have the lowest energy (make sure this state is allowed by Pauli's exclusion principle – i.e., you can build an anti-symmetric spatial wavefunction)
II. For a given spin, the state with the highest total orbital angular momentum L, consistent with Pauli's exclusion principle, will have the lowest energy
III. If a subshell is no more than half filled, the lowest energy level has J=|L-S|; if it is more than half filled, then the lowest energy level has J=L+S