

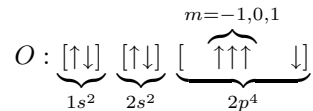
Problems:

9.21, 9.22, 9.23, 924, 9.26

- What is the electronic structure of Ne. Make an educated guess about its chemical reactivity.

Atoms

- Electrons fill up orbitals one by one. There are some things to know when filling up the shells
 - After filling the $3p$ orbital, one starts filling the $4s$ orbital before filling the $3d$ orbital. This is because the $4s$ state is actually lower than the $3d$ state as shown below. They are very close however.
 - **Hunds Rule.** Take filling up the $3p$ orbital for example. When filling up the $2p$ orbital one first fills up the m levels with the same spin, and then one starts the process again for the next spin. See Fig. 9.15 of the book for a good explanation. Thus the structure of Oxygen is the following



where each arrow represents an electron.

- **Moseley's Law** When an electron in an inner shell is knocked out, other electrons decay down to fill their spot, emitting keV X rays. These X rays are known as K_α lines and were used to determine the Z of the nucleus. If a $1s$ electron is knocked out, then the nucleus is only screened by a single remaining $1s$ electron. The $2p$ electrons will decay down to fill the void. The energy of the photon emitted during this transition is

$$E_{2 \rightarrow 1} \simeq \frac{k_C e^2 (Z - 1)^2}{2a_0} \left(\frac{1}{1^2} - \frac{1}{2^2} \right) \quad (1)$$

You should know where this comes from. For instance suppose a $2p$ electron is knocked out then. Then you should understand why the a $3s$ electron decaying to this $2p$ slot gives a photon of energy

$$E_{3 \rightarrow 2} \simeq \frac{k_C e^2 (Z - 9)^2}{2a_0} \left(\frac{1}{2^2} - \frac{1}{3^2} \right) \quad (2)$$

This is because there are approximately nine electrons screening the nuclear charge. The problem is essentially the Bohr model with $Z_{\text{effective}} = Z - 9$. (2 electrons from the $1s$ orbital, 2 electrons from the $2s$ orbital, 5 electrons from the $2p$ orbital.)