

**EVE 403**  
**Atmospheric Chemistry**  
Homework #1  
Spring 2020

**Tentatively Due: 17 January, 2020**

1. (a) Taking a positively-charged particle with charge +1 and six negatively-charged particles, each having a charge of  $-1$ , define three planar configurations that would result in no net electrostatic force being exerted on the positive charge.  
  
(b) Perform the same exercise as in part (a); however, in this case, define two stable configurations in 3-D space. Do your best with the sketches.

**Note:** Configurations having the same basic geometric pattern and differing only in the “ $r$ ” distance between the positive and negative charges should not be considered new configurations. Recognize also that this is meant to be a qualitative problem and does not require detailed numerical calculations.

- (c) Of the two configurations considered in (a), which one would you consider to be the most stable and why? If you need to make any assumptions or specify boundary conditions in providing your answer, please state them. Repeat the exercise for your configurations in (b).
2. Develop a complete set of quantum numbers (recall the in class exercise we completed, and don't worry about the proper “ordering”) for the following atomic species: Al, K, Kr, and Mo.
3. Write electron configurations for each of the following species: Al, Si,  $K^+$ , Kr and Mo. If there are any unusual configurations provide an explanation.
4. In our discussions of the atomic nucleus, we concluded that it was made up of protons and neutrons. Based on our electrostatic discussions, however, it would appear that the nucleus should be very unstable due to the repulsion between the positively-charged protons. Explain the stability that characterizes most atomic nuclei.
5. Estimate the wavelength of a baseball smacked out of the park by your classmate, Eli Young.