

Assignment 1

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Submit to Paul by Thursday 10/07/2004. Keep answers short.

1. Write out the complete electronic configuration for the following species:
 - (a) N, Si, Ga
 - (b) N^{+3} (as in NF_3), Si^{+4} (as in SiO_2), Ga^{+3} (as in GaN)
2. For the transition metals (from Ti through Cu, from Y through Ag and La through Au) the electronic configurations are a little more difficult to write out. Firstly we use a shorthand notation: For Ti, for example, we write $[Ar]4s^23d^2$ where [Ar] refers to Ar — that takes care of everything earlier than K. Similarly, for Y, we would write $[Kr]5s^24d^1$. We then use the rule that s electrons are removed first, and that s^0 , d^5 and d^{10} are stable — we should form these when we have the choice. For example, Cu is $[Ar]4s^13d^{10}$, Cu^{1+} is $[Ar]4s^03d^{10}$ but Cu^{2+} is $[Ar]4s^03d^9$. Write the electronic configurations (in the shorthand notation) for:
 - (a) Ag, Ag^+ , Au, Au^{3+}
 - (b) Co^{3+} , Fe^{3+} , Zn^{2+}
3. How many electrons must be **removed** from Si so that it has the electronic configuration of the nearest noble gas (and which gas). How many electrons must be **added** to Si so that it has the electronic configuration of the nearest noble gas (and which gas). What does this tell us about the nature of Si? What do you expect the configuration of Si to be in SiO_2 (sand) and in the hypothetical compound Na_4Si .
4. Use the periodic table and the electronegativity periodic table to guess the nature of bonding in the following:
 - (a) GaN, GaP, GaAs, GaSb (is there a trend?)
 - (b) CsAu, MnBi, LiAlSi (this last one is a bit tricky!)
5. Atoms and ions in solids are held together by some attractive force. In the absence of any sort of attraction, can a gas be turned into a crystalline solid? How?