Prerequisites for Section V (3 weeks)

Chemistry of the non-metals

• The descriptive part of this course will draw on fundamentals as a tool for organizing and understanding what would otherwise be a stream of unconnected facts. If you take the time to try and “rationalize why” facts that you are presented with somehow make sense, or at least “fit” with others, you will likely find the task of remembering the facts easier.

  a. Hydrogen and its compounds

• Recall unique role of hydrogen bonding – most important for H bound to highly electronegative atoms: F, O, N, and to a lesser extent, Cl, S. H-bonding is important in many contexts: in ‘protic’ solvents, H₂O, NH₃, HF, alcohols, etc.; in many areas of molecular biology (protein structure, DNA base pair binding, intermolecular forces in starches and cellulose, etc.).
• The almost exclusively univalent structural role of hydrogen (i.e., bound to only one other atom) is by no means universal hydrogen compounds throughout the rest of the periodic table — especially with metals and with elements that are considerably less electronegative than hydrogen (transition elements, B, Be, Al, etc.)
• H₂ is the lightest diatomic molecule and has a small moment of inertia – which means that it has much more widely spaced rotational levels than any other gas (see any P-chem text). You should review the origin of rotational energy levels before I discuss ortho- and para-hydrogen.

  b. Boron compounds, other group 13 compounds, inorganic carbon, other group 14 chemistry

  c. Chemistry of groups 15 and 16

• There are some parallels between organic chemical reactions and those of the other main group elements. For example, you should refresh your memory concerning the reactivity of Grignard reagents or lithium alkyls, because the serve similar roles in much of main-group inorganic chemistry. The organic reactions of alcohols and amines are important too in the chemistry of boron or phosphorus. Alkyl and aryl halides are important precursors to useful organic compounds; halogenated derivatives of boron-, aluminum-, silicon-, and phosphorus-based compounds are similarly important.

  d. The halogens

Sources: Handouts SA: Selections from Chapters 8, 10, 11, 12