Course Expectations: Essential Capabilities for Starting (and Ending!) this Class

As an advanced class, Organic Chemistry at Blair is generally taken to be a second course in chemistry; it is assumed that students have at their recall some very basic skills, most of which have been taught in multiple classes in middle and high school level. Students should be able to do the following tasks, or (mostly) learn to manage them on their own with limited recourse to the teacher or class time:

I. Mathematical skills
   A. Set up "word problems" as mathematical relationships
   B. Set up and solve linear equations
   C. Represent and manipulate equations involving variables other than (x,y) (e.g., p,V,T or m,V)

II. "General" Science Skills
   A. Setting up, maintaining an IMRAD formatted lab notebook as done in Honors-level biology, chemistry or physics.
   B. Writing an effective lab report - turning notebook entries into 3rd-person reader-friendly but formal reports of what was done and why.
   C. Data analysis - evaluating the quality of data and its interpretation; handling sigfigs properly
   D. Reading and producing graphs effectively
   E. General lab awareness and ability with standard equipment (test tubes, flasks, beakers, thermometers, ovens, hotplates and burners, filtration hardware, balances). Specialized hardware will be taught as needed.
   F. Switch from scientific notation for metric quantities to their representations with metric prefixes and back easily; have fast-memory access to metric prefixes from pico(p) to tera(T) e.g. 19pm = 0.019nm = 1.9×10^{-11}m
   G. Given needed conversion factors, convert between any given systems of units
   H. Read a text of appropriate level (e.g., a high-school level Organic Chemistry textbook) and extract most of the needed information and ideas with limited intervention from the instructor
   I. Follow a logical argument

III. Chemical Content Knowledge
   A. Scientific method & scientific judgement - spread, error, validation of hypotheses
   B. Classification -
      1. By physical state
      2. By organization of material (element/compound/mixtures, terminology)
      3. Physical, chemical properties of materials
      4. Physical, chemical changes
   C. Basic laws and structures
      1. Mass conservation, definite composition, multiple proportions
      2. Elementary atomic structure (electrons, nuclei)
      3. Standard isotope/ion notation
      4. Chemical bonds as electron sharing
   D. Elementary equation balancing
   E. Moles and stoichiometry
      1. Moles to atoms, molecules
      2. Moles to mass
      3. Moles to volume of gases or condensed phases

4. Moles(A) to moles(B) (reactions)

F. Thermochemistry - familiarity is encouraged but not requisite

G. Aqueous Solutions - concentration and dilution problems should be understood with minimal review

IV "Nice-to-haves": Things we don't do every year in Honors Chem but should

A Kinetics - reaction rate, rate law, mechanism, catalysis

B Kinetic theory of matter

C Acids and bases

ESSENTIAL QUESTIONS OF THE COURSE

1. How do we think about a system of 12 million chemicals and their trillions of reactions successfully?
2. How do we safely separate, characterize and react organic chemicals?
3. How does the work of organic chemists and chemical engineers affect our society?