CHAPTER 1

1. **Homework** – [look over all problems and look at the answers on A-1 in the back of the book. But don't get lost in mathematical busy-work]. Life is an "emergent property" of biomolecules – it can't be predicted by looking at the individual parts. Progenote also called "LUCA" – last universal common ancestor. LUCA was much like us, with ribosomes and enzymes and ATP. There must have been much simpler cells earlier on. Life is characterized by the flow of energy – often it is in a steady state, like a candle flame. A flame can appear motionless but is the site of powerful oxidation reactions. Important take-home lessons in this chapter include the four WEAK FORCES, i.e. van der Waals, Hydrogen bonds, ionic forces, and hydrophobic forces. Know their properties and strengths. All are about 20 times weaker than covalent bonds. The most common atoms in living cells are CHON, partly because smaller atoms form stronger covalent bonds. Understand "stick and P" drawings as done in class. Have a grasp of scale as shown on page 8. Understand that biopolymers are directional (p. 12), so that nucleic acids are shown 5' to 3' and peptides are "amino to carboxy". Know, in general terms, distinctions between Archaea, Eukarya, and Bacteria.

CHAPTER 2

1. **Homework** 1-6. Understand the properties of water. Why is it so cohesive, why is the boiling point so high, why does ice float and not sink? Understand that soluble molecules (ions or proteins) are covered by a "hydration shell" but hydrophobic molecules cause formation of an ice-like "clathrate" – low in entropy and missing H-bond energy compared to the hydration shell (In Chapter 3 we will learn that \( \Delta G = \Delta H - T\Delta S \), discussed in class in this context). Review how logarithms work, \( \log (AXB) = \log A + \log B, \) and \( \log (1/A) = -\log A, \) etc. pH is the negative log of \([H^+]\), the molar concentration of protons (actually hydronium ions). You should understand the math in this chapter, and be able to use the Henderson Hasselbalch Equation (p. 41).

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\text{pH} = \text{pKa} + \log_{10}\left(\frac{[A]}{[HA]}\right)
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Know that an ionizable molecule tends to be a good buffer at pH values close to the pKa. When pH = pKa there is a 50/50 mixture of two charge forms. Looking at the graphs on pages 44-45, you can see that near the pKa values, adding small amounts of OH\(^-\) or H\(^+\) does not produce a significant change in pH. Because different enzymes are most effective at different pH environments (see Fig 2.15 page 44) biochemists have to learn how to make buffers for any given pH. Several popular buffers are discussed in the chapter (p. 45-46).

Emergence article: http://users.openverse.com/~dtinker/emergent.html

LUCA article: http://www-archbac.u-psud.fr/Meetings/LesTreilles/LesTreilles_e.html