

Chemistry 4055 (Spring 2013)
Biochemistry I- Introduction to the Chemistry of the Animal Cell
Chapter 1 and 2 HW Assignment

Chapter 1

1. All biochemical reactions are thermodynamically driven as we have discussed in class. A good measure of whether a reaction will be thermodynamically favorable or spontaneous is the value for Gibb's free energy ($\Delta G < 0$).

$$\Delta G = \Delta H - T\Delta S$$

What values of ΔH , T, and ΔS will give you $\Delta G < 0$?

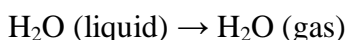
2. Given that a reaction is thermodynamically favorable, does it say anything about how fast a reaction will take place? Explain.

Chapter 2

1. Hydrogen bonding is one of the most important properties of water. That said, hydrogen bonding is weaker than covalent bonding as measured by the bond dissociation energy (kJ/mol). What correlation can you draw between bond dissociation energy and bond length from the table below?

Bond	Bond Dissociation Energy (kJ/mol)	Bond Length (nm)
O-H (Hydrogen Bond)	23	0.177
O-H (Covalent Bond)	470	0.0965

2. The phase transition of water from a liquid to a gas has a positive ΔH value? Why is that? How is it that this process has a $\Delta G < 0$ value?



3. What physical property of oxygen could contribute to its concentration being a limiting factor for aquatic animals in deep water?

4. What is the driving force behind the formation of micelles?

5. How are water molecules at the interphase of a mixture of water with a nonpolar solvent different from "free" water molecules?

6. List the four main weak interactions that occur in water. Why would a zipper or a Velcro strip be an appropriate analogy to weak interactions in biochemical reactions?

7. Which of the following would have higher osmotic pressure, an aqueous solution with 2 mol of NaCl or with 2 mol of glucose?

8. What are the concentrations of H^+ and OH^- at a pH of 10.0?
9. For a multiproton containing acid, the first proton is dissociated more readily than subsequent protons. Do you expect the pK_a for the dissociation of the first proton to be higher or lower than the subsequent protons?
9. Define the buffering region of a weak acid relative to its pK_a .
10. How does the Henderson-Hasselbach equation prove that the pK_a of a weak acid is equal to the pH of the solution at the midpoint of its titration?
11. What is the buffering system that operates in blood plasma?
12. How are the water reactions of hydrolysis and condensation related?