

NAME _____

MMBB 380 - Fall 2007
HOMEWORK #1 - ACID/BASE/BUFFERS

Homework is due one week after assignment. This homework (Assignment #1) is due Wed Aug 29 at the start of the 380 extra hour (5:30 pm). You may turn in the assignment at an earlier time. Show *all* work; answers alone are not sufficient. Use extra paper if necessary.
(6,000 pts)

1) The pH of a 0.175 M solution of a weak acid was measured at 3.44 (pH = 3.44)

(2,000 pts)

a) What is the $[H^+]$ in this solution?

(4,000 pts)

b) This solution was made by adding pure acid to pure H_2O . Determine the pK_a of the weak acid.

(6,000 pts)

2) Buffers like Tris and Hepes are ubiquitous in biological laboratories. You may have to refer to your book or other references to answer the following questions.

(1,500 pts)

a. Draw the protonated and unprotonated structures of Tris (also known as Trizma base).

(1,500 pts)

b. You have to make a pH 7.40 buffer for use at 20°C using only Tris ($pK_a = 8.23$) or MES ($pK_a = 6.15$). Which of the two would be best? Briefly explain your choice.

(3,000 pts)

c. Using the buffer identified in part b, you have to make a 0.10 M solution of the buffer that will be pH 7.40. You can only use 0.10 M solutions of the base (unprotonated, A) and the acid (protonated, HA) form to prepare this solution. In order to make 600 ml of the solution, determine the volume of 0.10 M HA and 0.10 M A⁻ needed.

(4,000 pts)

3) Like phosphoric acid, arsenic acid acts as a triprotic acid in aqueous solutions. This means that the arsenate can exist in one of four protonation forms. Draw the structure of these four forms.



Identify the predominant form of arsenic acid (arsenate) at each of the following pH's.

a) pH 1 _____

b) pH 3 _____

c) pH 5 _____

d) pH 7 _____

e) pH 9 _____

f) pH 11 _____

(4,000 pts)

4) (a) What is the difference between strong and weak acids?

(b) Give an example of a:

weak acid:

strong acid:

weak base:

strong base: