Name _____

Chem 352 - Fall 2018
Quiz 1

$R = 8.314\ J/(mol \cdot K) = 0.08206\ (L \cdot atm)/(mol \cdot K)$ [Ideal Gas Law Constant]
$K_w = 1.00 \times 10^{-14}\ M^2$ [Ionization Product for water]

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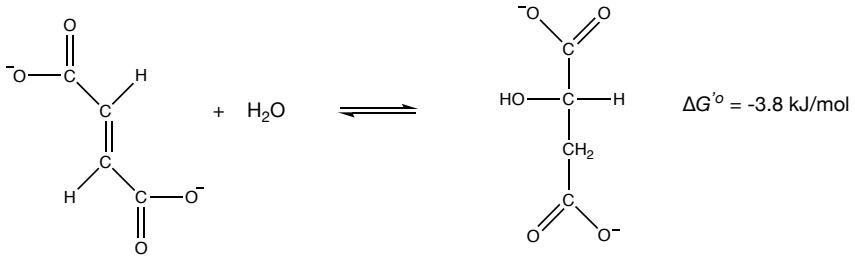
1. One of the reactions in the citric acid cycle pathway, a pathway used in the complete oxidation of glucose to CO_2 and H_2O, involves the hydration of *fumarate* to form *L-malate*.



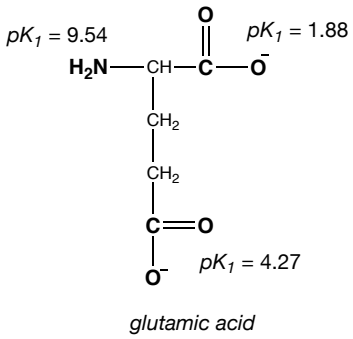
fumarate *L-malate*

   a. Is the reaction favorable under standard state conditions at 37°C? (Y/N)_____
   Explain:

   b. What is the value of the equilibrium constant, K_{eq}, for this reaction at 37°C?

   c. If the cellular concentration of *fumarate* is 1.33 mM, and the concentration of *L-malate* is 8.55 mM, is this reaction favorable under conditions found in a cell at 37°C? (Y/N) _____
   Explain:

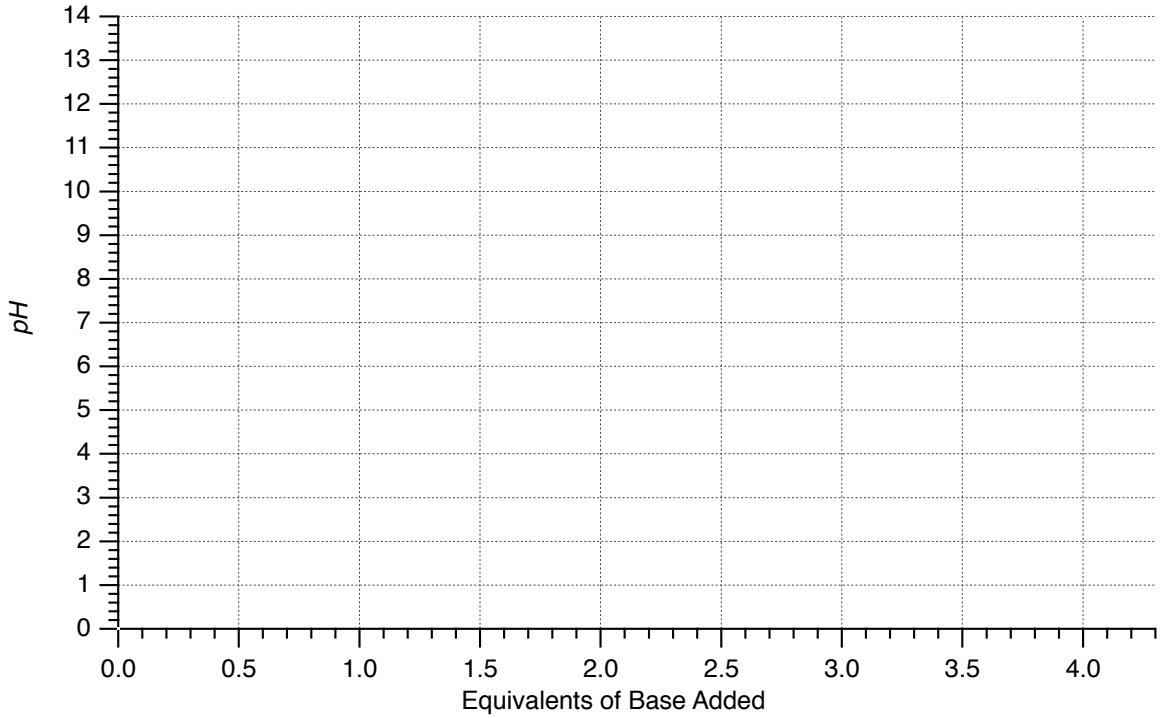
2. The structural formula for the amino acid glutamic acid is shown to right. Glutamic acid contains three ionizable groups; the structure shown has all three of these groups in their *deprotonated*, *conjugate base* forms. The pK_a values for these three groups are indicated in the figure.



glutamic acid

   a. What is the expected *pH* for a 150 mM solution of glutamic acid in its *fully protonated* form? (show calculations)

   b. Sketch the titration curve for a 150 mM solution of glutamic acid.



   c. In solution, at what *pH* does the predominant (major) species of glutamic acid have a *net charge* of 0? *pH* = _____

   (This *pH* is also called the *isoelectric point*, *pI*, because at this *pH* glutamic acid does not move in an electrostatic field.)

   d. Draw the structure for the predominant species of glutamic acid that is present at its isoelectric *pH*.