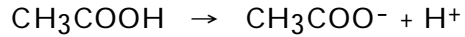


Practice problems for thermodynamics

- 1) The dissociation of acetic acid has an equilibrium constant of 1.75×10^{-5} at 25°C . What is the standard free energy change for this process at 25°C ?
- 2) The standard free energy change for the dissociation of benzoic acid is 23.97 kJ/mol . What is the equilibrium constant at 25°C ?
- 3) The standard free energy change for the dissociation of benzoic acid is 23.97 kJ/mol . What is the free energy change at 25°C if the concentration of benzoic acid is 0.105 M , the concentration of the benzoate ion is $1.05 \times 10^{-6} \text{ M}$, and the pH is 6.903 ?
- 4) The conversion of glucose-1-phosphate to glucose-6-phosphate by the enzyme phosphoglucomutase has a standard free energy change of -7.60 kJ/mol . Calculate the equilibrium constant for this reaction at 25°C .

5) Acetic acid dissociates in water according to the following equation:



At equilibrium, the pH was found to be 3.377, $[\text{CH}_3\text{COO}^-] = 4.20 \times 10^2 \mu\text{M}$ and $[\text{CH}_3\text{COOH}] = 10.0 \text{ mM}$. What are ΔG° and ΔG at 25 °C?

6) In an *E. coli* cell, the concentrations of ATP, ADP and inorganic phosphate might be 7.90 mM, 1.04 mM and 7.9 mM, respectively. Given that the hydrolysis of ATP has a standard free energy change taken at pH 7.0 (ΔG°) of -30.0 kJ/mol, what is the standard free energy change, ΔG° , for this hydrolysis reaction (pH 0)? Calculate the free energy change, ΔG , for this reaction in the cell at 37.0 °C and buffered at pH 7.0.

The hydrolysis of ATP:



7) What is the biochemical significance of the equation $\Delta S_{\text{univ}} = \Delta S_{\text{sys}} + \Delta S_{\text{surr}}$?