Summary of formulas and constants used in biochemistry

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Constants

$$R = 0.008314\ kJ \cdot mol^{-1} \cdot K^{-1}$$
$$T\ in\ K = T\ in\ ^{\circ}C + 273.15$$

Free energy

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

Free energy and concentration:

$$aA + bB \rightleftarrows cC + dD$$
$$\Delta G^{\circ\prime} = -RTln\left(K_{eq}\right) = -RTln\left(\frac{[A]_{eq}^{a}[B]_{eq}^{b}}{[C]_{eq}^{c}[D]_{eq}^{d}}\right)$$
$$\Delta G = \Delta G^{\circ\prime} + RTln\left(\frac{[A]^{a}[B]^{b}}{[C]^{c}[D]^{d}}\right)$$

The standard state condition is defined as all products and reactants at 1 M, 25C, 1 atm pressure, pH 7.0.

pH:

$$M \cdot H \overset{K_a}{\rightleftarrows} M + H^{+}$$
$$K_a = \frac{[M][H^{+}]}{[M \cdot H]}$$
$$pH = -log_{10}\left([H^{+}]\right);\ pK_a = -log_{10}\left(K_a\right)$$
$$\theta = \frac{[M \cdot H]}{[M] + [M \cdot H]} = \frac{1}{1 + K_a/[H^{+}]} = \frac{1}{1 + 10^{(pH - pK_a)}}$$