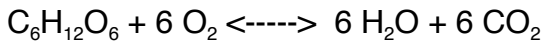


Biology 131 Practice Thermo Problems

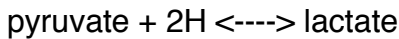
(one correction made on 11/7/07)

1. For the following reaction:



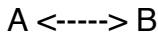
- (a) if all species are at a concentration of 1 M, what is the value of the mass action ratio?
(b) Assume that K_{eq} for this reaction is 100. Is the mix just given at equilibrium?

2. For the reaction:



where the concentrations of pyruvate and H are both 2 M and lactate is 1M; what is the value of q ?

3. For the system:



suppose that $q = 0.5$ and $K_{eq} = 1.0$

- (a) Which reaction, if any, is spontaneous? Give the sign of delta free energy for the system compared to equilibrium.
(b) Same system, except now suppose that $q = 0.5$ and $K_{eq} = 0.4$ – which reaction, if any, is spontaneous? Delta G sign for system?
(c) Same system but now $q = 2$ and $K_{eq} = 2.1$; same question as before. Delta G sign for system?

Answers: 1(a) $q = 1$; (b) no, $q \ll K_{eq}$

2. 0.125

3.(a) forward is spontaneous since there are far fewer products to reactants (for this simple reaction system it is 0.5P to 1 reactant) than found at equilibrium (1 product to 1 reactant). Negative ΔG .

(b) reverse is spontaneous; again looking at the ratio, there are 0.5 product to each reactant in the actual mixture but the equilibrium mix should have 0.4 to 1 – so there are "too many" products and thus, the reverse reaction is feasible.

Positive ΔG for forward reaction

(c) forward is spontaneous – there are 2 product molecules to each reactant and at equilibrium there are supposed to be 2.1. Negative ΔG