Problem Set 13 BB 450 / 550

1. Glycolysis is unusual in having three regulated enzymes. Why is it important that the very last enzyme of the pathway is regulated?

2. A cell has an overly active lactate dehydrogenase. Predict how this cell might behave in high and low oxygen concentrations.

3. A brewer hopes to speed up the brewing process by adding oxygen to the vat. Predict the outcome of this action.

4. The "big bang" reaction is essentially irreversible. Using the Gibbs free energy equation, calculate the equilibrium ratio of products to reactants for the pyruvate kinase reaction, assuming it is occurring at 300 K.

\[ \text{PEP} \xrightarrow{\text{Pyr}^+ \text{ kinase}} \text{PYR} \xrightarrow{-31.4 \text{KJ/mol}} \text{GLYCOl} \]

\[ \text{PYR} \xrightarrow{\text{ATP}} \text{2-PG} \xrightarrow{\text{CTP}} \text{GLUCONEO} \]

2. LDH

\[ \text{PYR} \xrightarrow{\text{LDH}} \text{LACTATE} \]

\[ \text{NADH} \xrightarrow{\text{NAD}^+} \]

3. PDR

\[ \text{PYR} \xrightarrow{\text{PDR}} \text{Acetald} \xrightarrow{\text{EtOH}} \]

\[ \text{Acetyl-CoA} \xrightarrow{\text{C. A. C.}} \]

\[ \text{ALC. DH} \]

\[ \text{NADH} \xrightarrow{\text{NAD}^+} \]
4. $\Delta G = \Delta G^0' + RT \ln \frac{P}{R}$

$\Delta G = 0 = -31.4 \text{ kJ mol}^{-1} + (0.008314)(300) \ln \frac{P}{R}$

$31.4 = (0.008314)(300) \ln \frac{P}{R}$

$\ln \frac{P}{R} = \frac{31.4}{(0.008314)(300)} = 12.5$

$\frac{P}{R} = e^{12.5} = 267,990$