Biol/Chem 472 Quiz #1 NAME_____

Take home: due at 11am 1/18/08

1) (6 pts) **SHOW YOUR WORK**. Given the steady state concentrations and the thermodynamic data below, calculate ΔG at pH = 7.4 and 37 °C for the reaction catalyzed by GAPDH:

$$\mathbf{GAP + NAD^+ + P_i \rightarrow 1,3\text{-}BPG + NADH + H^+}$$

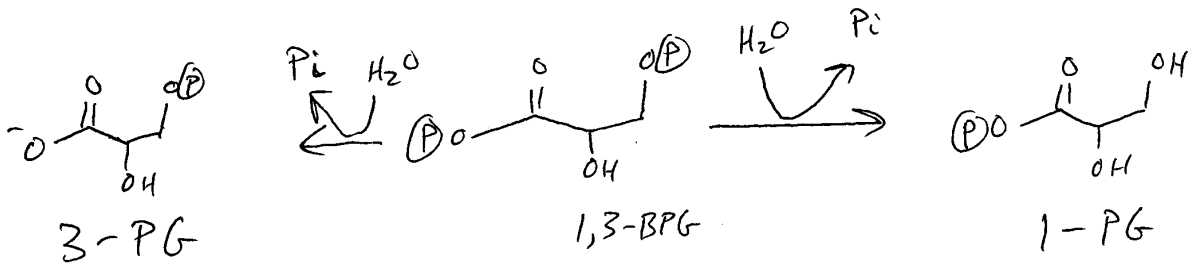
half reaction	**E°′ (V)**
$3\text{-PG} + 3H^+ + 2e^- \rightarrow GAP + H_2O$	-0.549
$NAD^+ + H^+ + 2e^- \rightarrow NADH$	-0.315

For: **$1,3\text{-BPG} + H_2O \rightarrow 3\text{-PG} + P_i + H^+$** **$\Delta G°' = -49.4$ kJ/mol**

Steady-state intracellular concentrations:

GAP = 0.019 mM, 3-PG = 0.12 mM, NAD^+ = 0.14 mM,
NADH = 0.017 mM, P_i = 1.3 mM, 1,3-BPG = 0.0015 mM.

2) (3 pts) Under intracellular steady state conditions where [1-PG] = [3-PG], which of the hydrolysis reactions shown below will be more favorable thermodynamically? **Support your answer with a concise argument**. It is not necessary to perform any numerical calculations to answer this question (indeed I have not provided sufficient information for you to do so). This question can be answered based on an understanding of basic thermodynamics and chemical reactivity that are evident from the study of Table 16.3 (p 566).



3) (6 pts) You are studying a newly discovered catabolic pathway in a deep-sea bacterium. This pathway is BRANCHED and produces two products, **H** and **J** from a common precursor **F**. You have determined that there are 5 intermediates in this pathway: **B, K, M, Q, Z**, and seven enzymes: **E1, E2, E3, E4, E5, E6 and E7**. You perform a series of experiments *in* vitro with an extract that contains each of the seven enzymes. You make seven separate samples of the extract and add to each sample an inhibitor that completely, and specifically, inhibits one of the enzymes in the mixture. You then add the precursor **F** and record whether or not **H** and/or **J** are produced, and what other intermediates (if any) accumulate. This data is shown in the table below. Using this data, draw a plausible scheme for the new pathway that shows the order of the intermediates between **F** and the final products **H** and **J**, as well as the enzyme that is responsible for each step.

Enzyme inhibited	H produced?	J produced?	Pathway intermediates that accumulate
E1	No	No	F, Q
E2	Yes	No	Z
E3	No	Yes	B, K
E4	No	No	F
E5	No	Yes	K
E6	No	Yes	None
E7	Yes	No	None

For example, your answer should look something like this (note that this is not the correct answer):