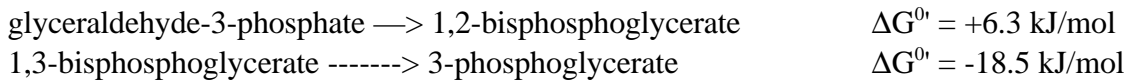


CHEM 786  
SAMPLE TEST I

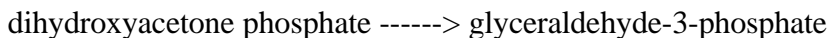
Useful information:  $R = 8.315 \text{ J/mol}\cdot\text{K}$  ;  $\mathcal{F} = 96480 \text{ J/V}$  ;  $T = 37^\circ\text{C}$  ;  $N = 6.022 \times 10^{23}/\text{mol}$

1. During glycolysis, glyceraldehyde-3-phosphate is converted to 3-phosphoglycerate in two successive steps:



Calculate the free energy change for the cumulative reaction.

2. When a mixture of glyceraldehyde-3-phosphate and dihydroxyacetone is incubated at  $25^\circ\text{C}$  with triose phosphate isomerase until an equilibrium mixture is reached, the final mixture contains 0.03% more dihydroxyacetone than glyceraldehyde-3-phosphate. What is the value of the standard free energy change for the reaction:

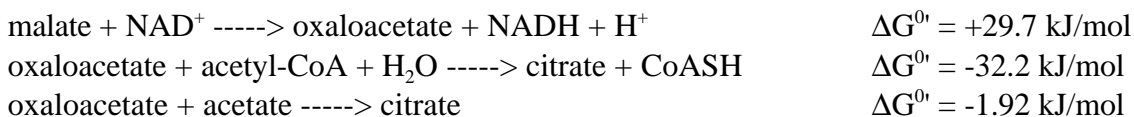


3. The standard reduction potentials,  $E^{0'}$ , for the following half reactions are given

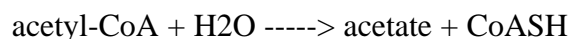


Under standard conditions, write out the thermodynamically favored cumulative reaction.

4. Given the information of the three reactions shown below:



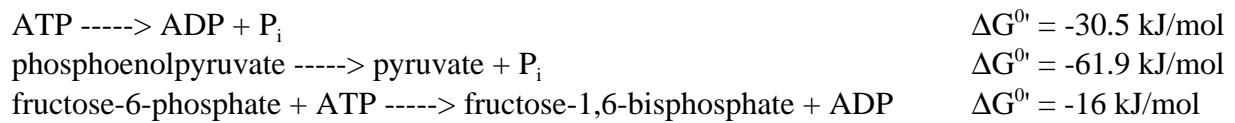
What is the  $\Delta G^{0'}$  for the hydrolysis of acetyl-CoA (shown below)?



5. The steps of glycolysis between fructose-6-phosphate and 1,3-bisphosphoglycerate include all of the following except:  
ATP hydrolysis, utilization of  $\text{P}_i$ , reduction of  $\text{NAD}^+$  to  $\text{NADH}$ , catalysis by aldolase, ATP synthesis
6. Fructose-1-phosphate inhibits aldolase. In an organism metabolizing glucose a substrate, which intermediate species would you expect to see increase in concentration?
7. Name the enzyme responsible for the conversion of glucose-1-phosphate to glucose-6-phosphate

8. Name three enzymes that are allosteric regulation points for glycolysis.
9. Of the following, which carbohydrate is not capable of feeding into the glycolysis pathway?  
mannose, fructose, galactose, ribose, glucose
10. Which of the following is not required for the oxidative decarboxylation of pyruvate to form acetyl-CoA?  
NAD<sup>+</sup>, lipoic acid, ATP, CoASH, FAD
11. The conversion of 1 mole of acetyl-CoA to 2 moles of CO<sub>2</sub> via the citric acid cycle also yields \_\_\_ moles of NADH, \_\_\_ moles of FADH<sub>2</sub>, and \_\_\_ moles of ATP/GTP.
12. Which of the following will not activate pyruvate dehydrogenase production of acetyl-CoA?  
AMP, CoASH, fatty acids, Ca<sup>2+</sup>, NAD<sup>+</sup>
13. Which of the following is not a source of building materials via anaplerotic reactions?  
α-ketoglutarate, succinate, oxaloacetate, pyruvate, phosphoenolpyruvate
14. An inhibitor, X is specific to isocitrate dehydrogenase. If added to a cellular preparation that oxidizes pyruvate as a substrate, which intermediate would you expect to show a diminished concentration?
15. What cofactors are required for the conversion of succinate to fumarate.
16. Draw the structure of coenzyme A and identify the functional groups.
17. The E<sup>0</sup> of the FAD/FADH<sub>2</sub> half reaction is -0.219 V. The E<sup>0</sup> of the fumarate/succinate half reaction is +0.131 V. If the concentrations of all species is 10<sup>-5</sup> M, what is the “spontaneous” reaction.
18. In the conversion of acetyl-CoA to CO<sub>2</sub>, all of the following enzyme participate. Indicate the order in which they function by numbering them.  
  - \_\_\_\_\_ aconitase
  - \_\_\_\_\_ isocitrate dehydrogenase
  - \_\_\_\_\_ succinate dehydrogenase
  - \_\_\_\_\_ fumarase
  - \_\_\_\_\_ citrate synthase
  - \_\_\_\_\_ malate dehydrogenase
  - \_\_\_\_\_ α-ketoglutarate dehydrogenase
  - \_\_\_\_\_ succinyl-CoA synthase
19. If a solution of fructose-6-phosphate is catalyzed in the presence of ATP and phosphofructokinase-1, fructose-1,6-bisphosphate is formed. Give the information below, calculate the equilibrium constant

for this reaction.



20. Draw the structure of 1,3-bisphosphoglycerate and the product formed by its catalysis by phosphoglycerate kinase. Include cofactors where appropriate.
21. Draw the structure for the substrate and products involved in the catalysis by the enzyme aldolase. By numbering the respective carbons, show on the substrate where each of the carbons for the products comes from.
22. Show the three steps of the citric acid cycle that result in reduced electron carriers (cofactors), giving the name for each substrate and product and the name for the enzyme that catalyzes each step.