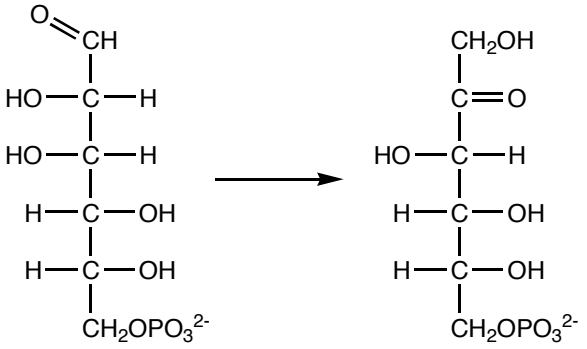
Name _____ Test 4

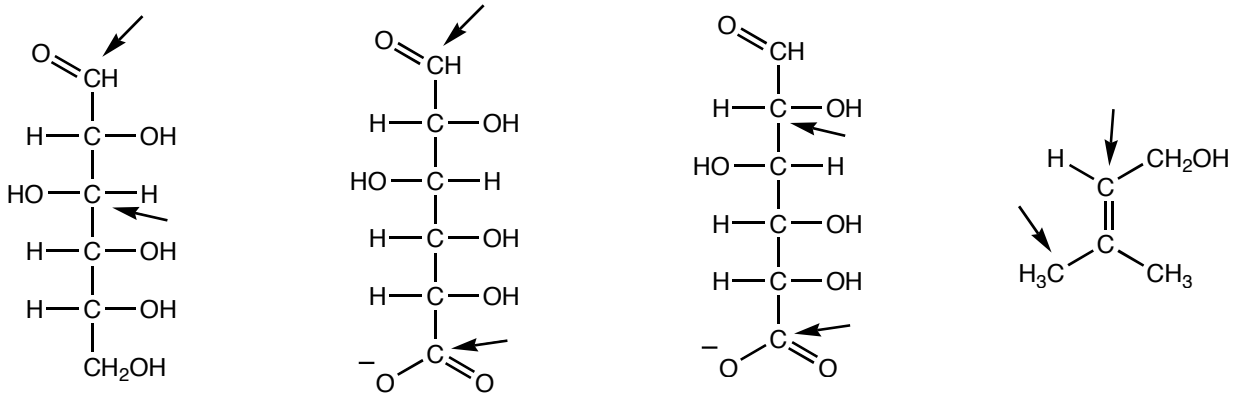
PHYS 0213 Spring 2004

1. (8 pts.) Mannose enters into glycolysis as fructose-6-phosphate. The conversion to fructose-6-phosphate occurs through an enediol intermediate.

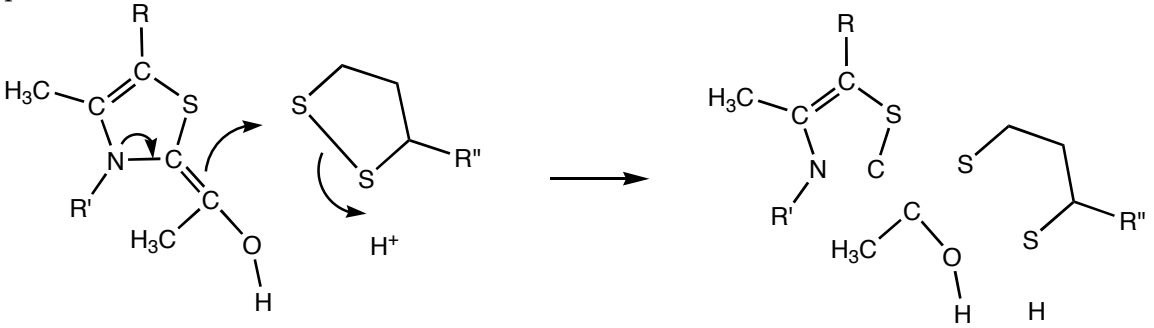
Draw the intermediate through which this transformation occurs.




2. (8 pts.) For each of the molecules, circle the more oxidized of the indicated carbon atoms



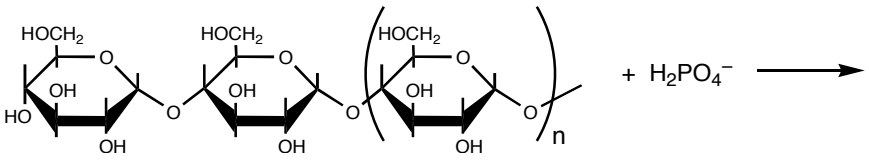

3. a. (6 pts) Based on the electron movement arrows, draw the correct bonds and charges on the product.




b. Oxidation-reduction wise, what is the significance of this step in the citric acid cycle.

4. The α-1,4 glycosidic linkage between the end of a glycogen chain and the second to last sugar residue is broken during the reaction of glycogen and dihydrogen phosphate.

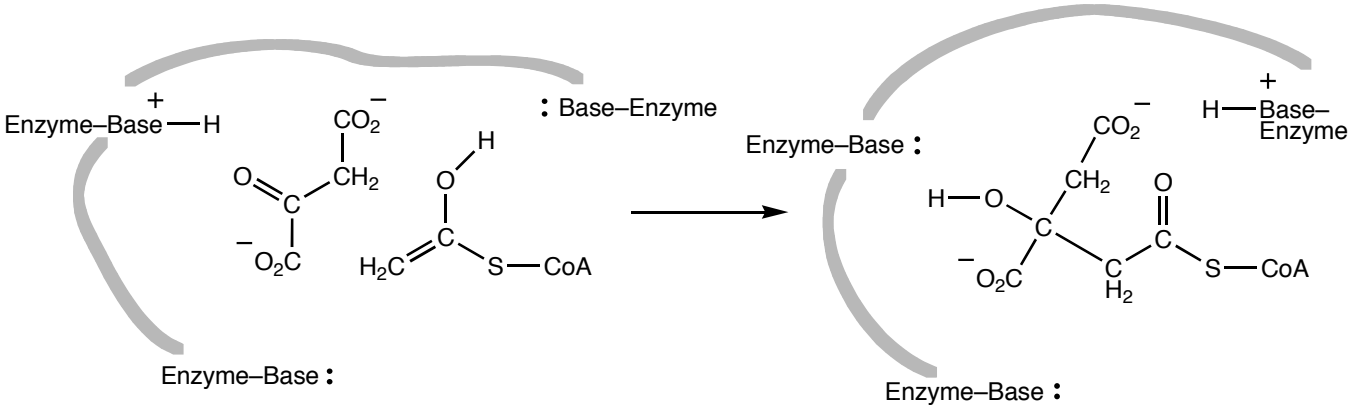
a. (6 pts.) Draw the products of the reaction.




b. (4 pts.) Is the 1,6 glycosidic linkage (not shown above) cleaved in the same manner, explain?

5. During the synthesis of citrate, the enol form of acetyl-CoA reacts with oxalloacetate.

a. (6 pts.) Use electron movement arrows to show how the electrons move to form the new intermediate.



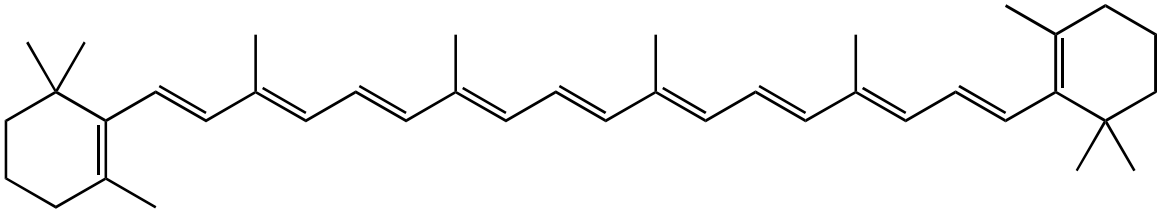

b. (6 pts.) Label the carbon atoms that act as the nucleophile and the electrophile.

6. (6 pts.) In Electron Transport Chain complex I, FMN is used to transfer electrons from NADH to Fe-S clusters. Why is the FMN reduction to $FMNH_2$ an important step during the transfer of electrons from NADH to the Fe-S cluster?

7. (10 pts.) The malate-aspartate shuttle is used to transfer NADH produced outside the mitochondria into the mitochondria. The glycerol-1-phophate/dihydroxyacetone phosphate shuttle is used to transfer the reducing power of NADH to $UQH_2$. Which pathway for bringing the reducing power of NADH into the mitochondria is more efficient, explain?

8. (10 pts.) The primary goal of the electron transport chain is to do what?

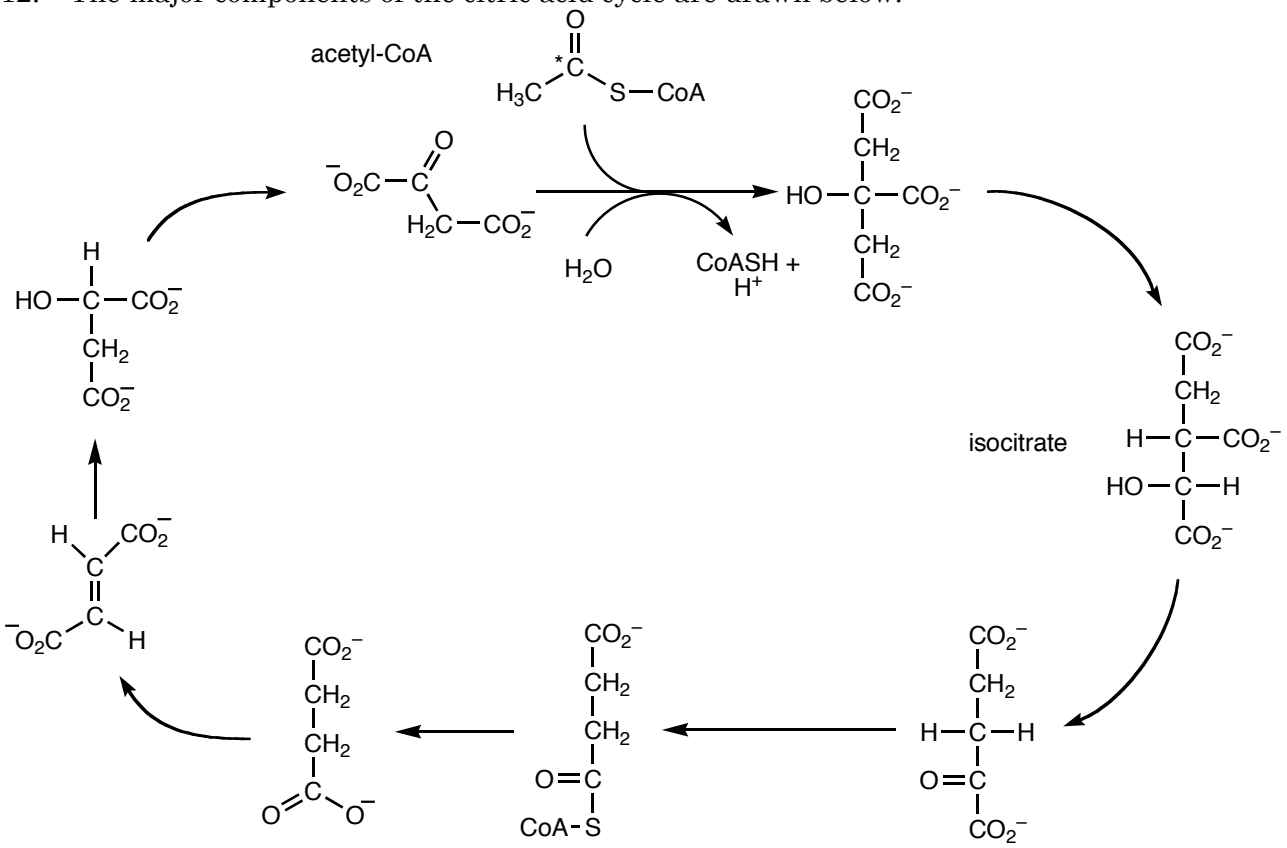
9. (10 pts) β-karotene is drawn below. What is it about its structure that makes it suitable for its role as a intra-membrane radical scavenger.



10. (10 pts.) Explain why a hydroxyl radical ($OH^{\bullet}$) is potentially more damaging to cells than other nonradical oxidizing agents like hydrogen peroxide ($H_2O_2$).

11. (10 pts.) Assuming that ATP production can be separated from the electron transport chain, explain why the pH of the mitochondrial intermembrane space increases as ATP synthesis occurs at ATP synthase.

12. The major components of the citric acid cycle are drawn below.




a. (6 pts.) Label the steps where both NADH and $CO_2$ are formed.

b. (6 pts.) There are two steps where the molecule is oxidized and a $CO_2$ isn't released. Label those steps.

c. (6 pts.) Determine which carbon atom on isocitrate originates from the carbon atom with a star next to it on the acetyl-CoA

d. (8 pts.) What is the principle purpose of the citric acid cycle?