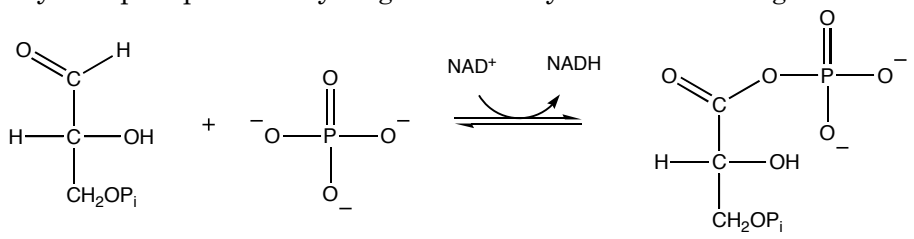
Name _____ Test 4 (5/7)
PHYS 0313 (Biochem) Spring 2007

1. Glyceraldehyde-3-phosphate dehydrogenase catalyzes the following reaction.



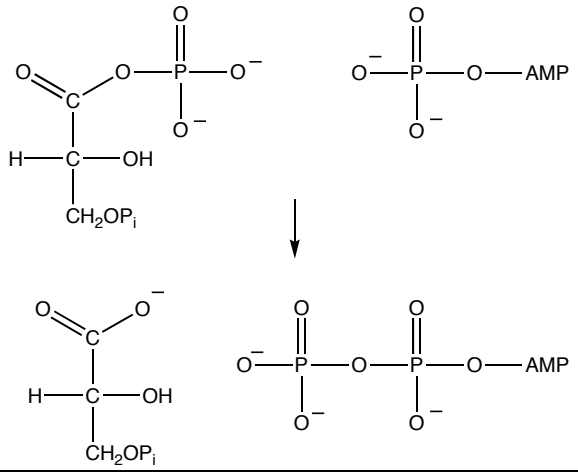
a. (6 pts.) What kind of reaction is this

oxidation reduction | nucleophilic substitution | isomerization | electrophilic addition | elimination

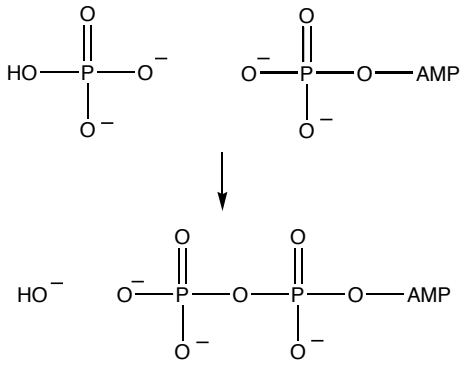
b. (8 pts.) Explain your choice

2. (10 pts.) Two reactions are pictured below. Which reaction is more thermodynamically favorable (consider each reaction on its own, not as part of a larger biosynthetic pathway)? Explain.

Formation of ATP from ADP during glycolysis



Formation of ATP from ADP and P_i

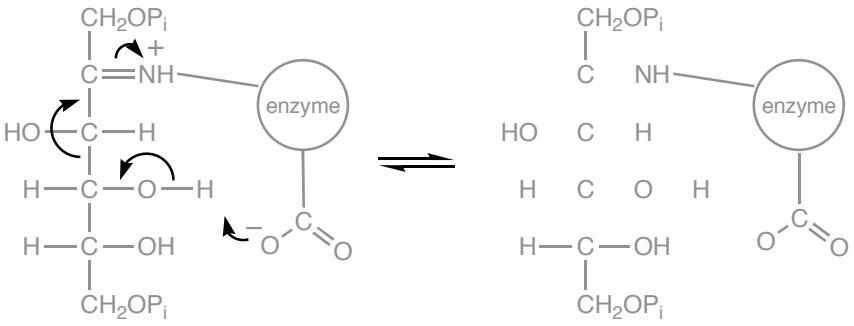


AMP = Adenosine monophosphate

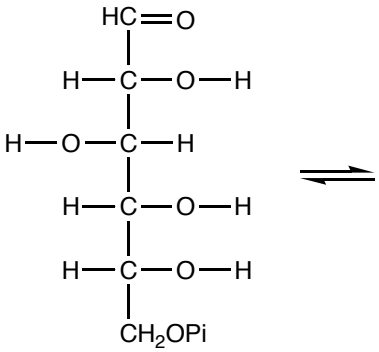
1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____

3. A crucial step in glycolysis is the conversion of fructose-1,6-bisphosphate to dihydroxyacetone phosphate and glyceraldehyde-3-phosphate.

a. (8 pts.) Complete the structure on the right.



b. (8 pts.) Imagine that the same reaction happens with glucose-6-phoshpate. Draw electron movement arrows and the two-carbon long and four-carbon long molecules that would result if glucose-6-phosphate underwent a reverse aldol condensation as fructose-1,6-bisphosphate does (the reaction drawn above).



4. In glycolysis, the following reaction is an irreversible reaction, yet, in gluconeogenesis, fructose-1,6-bisphosphate is converted to fructose-6-phosphate.

fructose-1-phosphate + ATP ⟶ fructose-1,6-bisphosphate + ADP

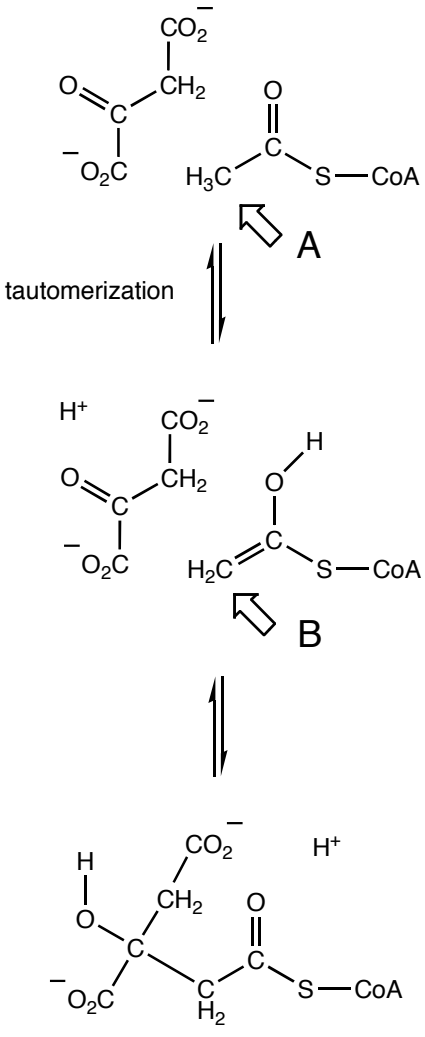
a. (8 pts.) Why is the reaction drawn above irreversible (short explanation)?

b. (8 pts.) How does gluconeogenesis get around this irreversible step?

5. (10 pts.) Considered at its most basic level, the role of the citric acid cycle is what?

6. (10 pts.) Acetyl-CoA transfers an acetyl group to oxaloacetate. The first two steps of the mechanism are drawn to the right.

How does the reactivity of the carbon labeled A change when the carbonyl is converted to its enol tautomer? For example, are either carbon atoms (A or B) nucleophilic?

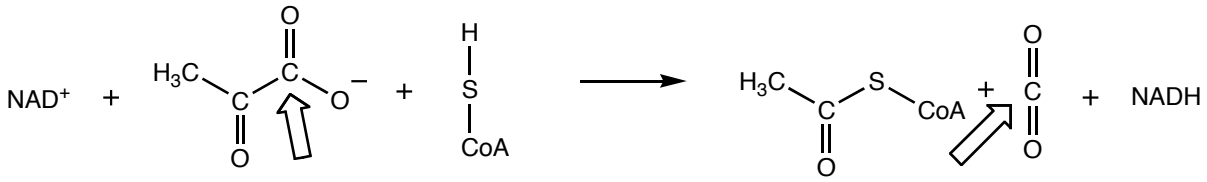


7. a. (6 pts.) Draw electron movement arrows to show how the bonds break and form in the second step drawn to the right

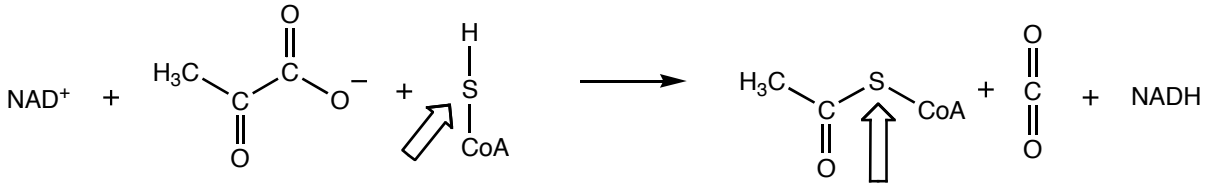
b. (6 pts.) Describe what the arrows that you have just drawn mean. For example, electrons move from X to form a bond between X and Y...

8. The pyruvate decaboxylase complex is responsible for transfering an acetyl group ($CH_3C{=}O$) to Coenzyme A. The acetyl group is generated by decarboxylating pyruvate. The overall reaction is shown below.

a. (5 pts.) Determine which of the indicated atoms is more oxidized



b. (5 pts.) Determine which of the indicated atoms is more oxidized

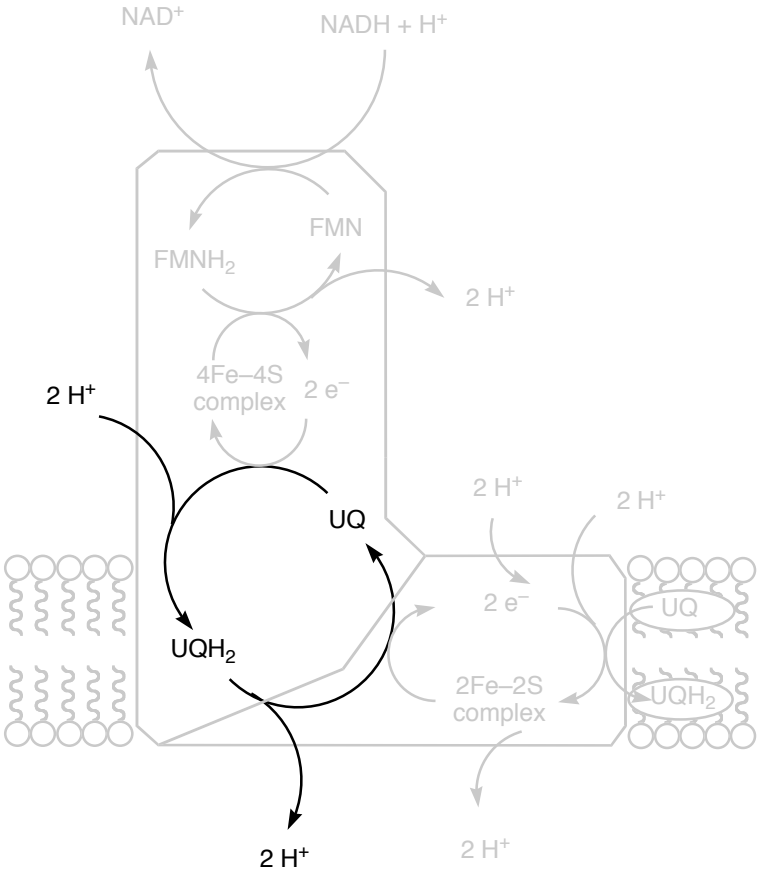


c. (6 pts.) What molecule is being reduced?

9. To the right is a diagram representing Complex I (NADH dehydrogenase) of the Electron Transport Chain.

a. (6 pts.) Indicate which side of the diagram is the mitochondrial matrix and which side is the mitochondrial intermembrane space.

b. (8 pts/) What is the significance of the UQ–UQH_2 redox cycle that is highlighted in the diagram.



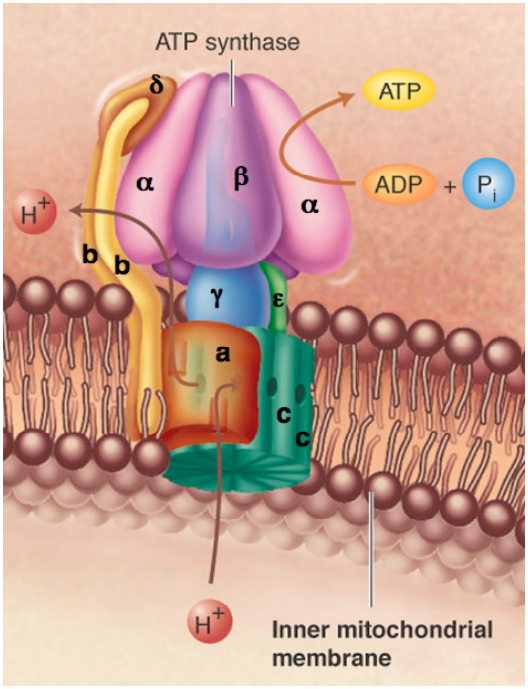
10. (10 pts.) What is the primary purpose of the Electron Transport Chain?

11. On the right is an artist's representation of ATP synthase.

a. (6 pts.) Indicate which side of the membrane is the mitochondrial matrix and which side is the intermembrane space.

b. (8 pts.) What drives this molecular machine?

c. (6 pts.) Provide one piece of evidence that supports your assertion in part b.



McKee and McKee, *Biochemistry*