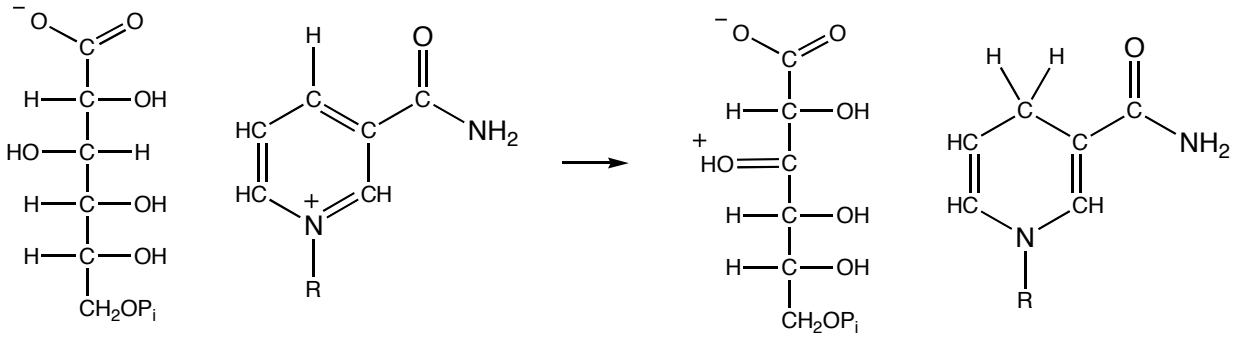
Name _____ Test 3
PHYS 0213 (Biochem) Spring 2006

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

1. Below is a redox reaction from the pentose-phosphate pathway.

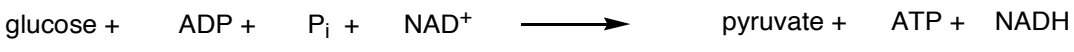


a. (4 pts.) Identify the C atom on the sugar that is participating in the redox reaction.

b. (4 pts.) Is that C atom (the C atom on the sugar) being oxidized or reduced?

c. (6 pts.) Draw electron movement arrows to show how the products form from the reactants.

2. a. (6 pts.) "Balance" the following chemical reaction that summarizes glycolysis.

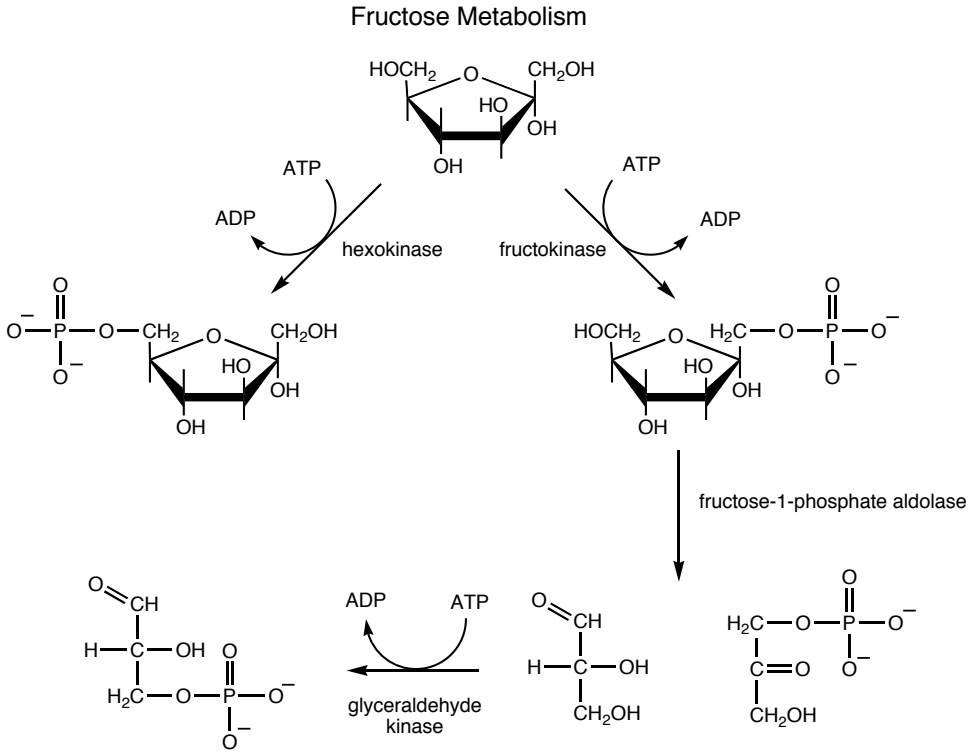


b. (6 pts.) Is ATP required for glycolysis to occur? If so, why isn't ATP included in the equation above?

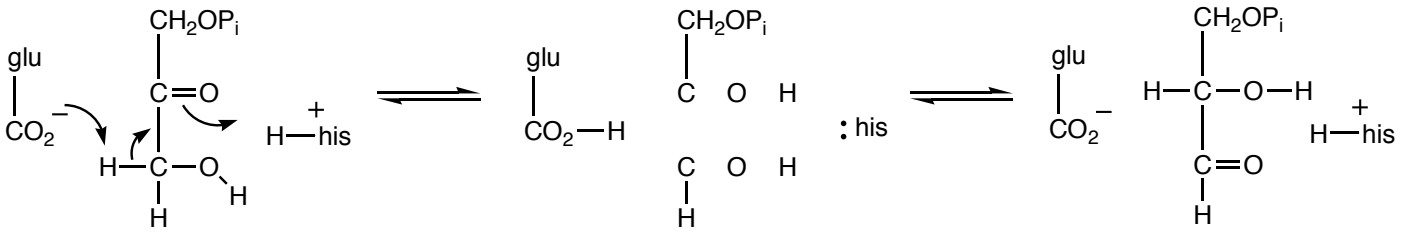
3. (10 pts.) ATP Synthase is a large molecular machine that synthesizes ATP. What drives this machine?

4. (8 pts.) The primary role of the Citric Acid Cycle (the Kreb's Cycle) is to do what?

5. Inhibition of the enzyme phosphofructokinase-1, which is an enzyme responsible for the conversion of fructose-6-phosphate to fructose-1,6-bisphosphate in glycolysis, does not inhibit the breakdown of fructose via glycolysis. Explain. (The pathways below may or many not help explain why fructose can still be metabolized).



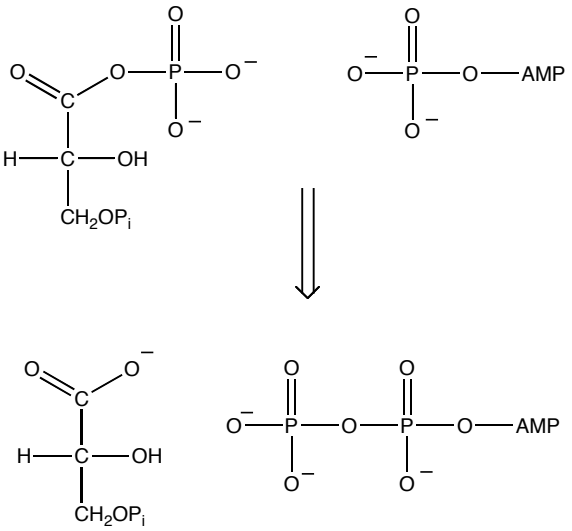
6. Electron movement arrows are drawn for the first step of the mechanism pictured below.



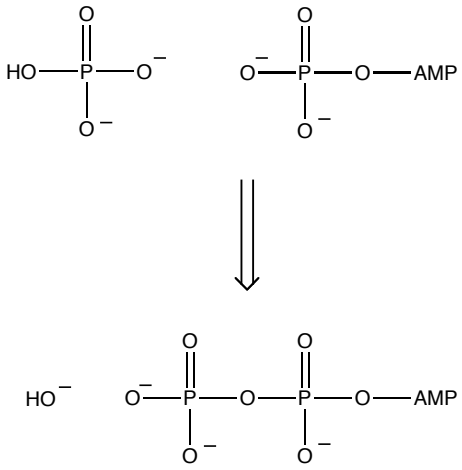
a. (5 pts.) Draw the bonds required to complete the intermediate in this reaction.

b. (5 pts.) Add electron movement arrows for the second step of the mechanism.

Formation of ATP from ADP during glycolysis



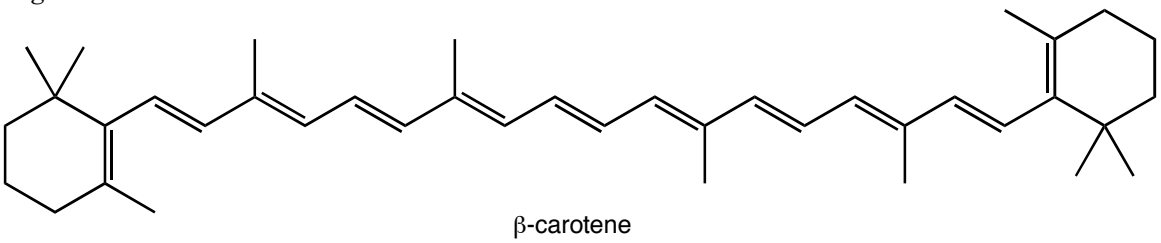
Formation of ATP from ADP and P_i



7. (10 pts.) Two reactions are pictured above. Which reaction is more thermodynamically favorable (consider each reaction on its own, not as part of a larger biosynthetic pathway)? Explain.

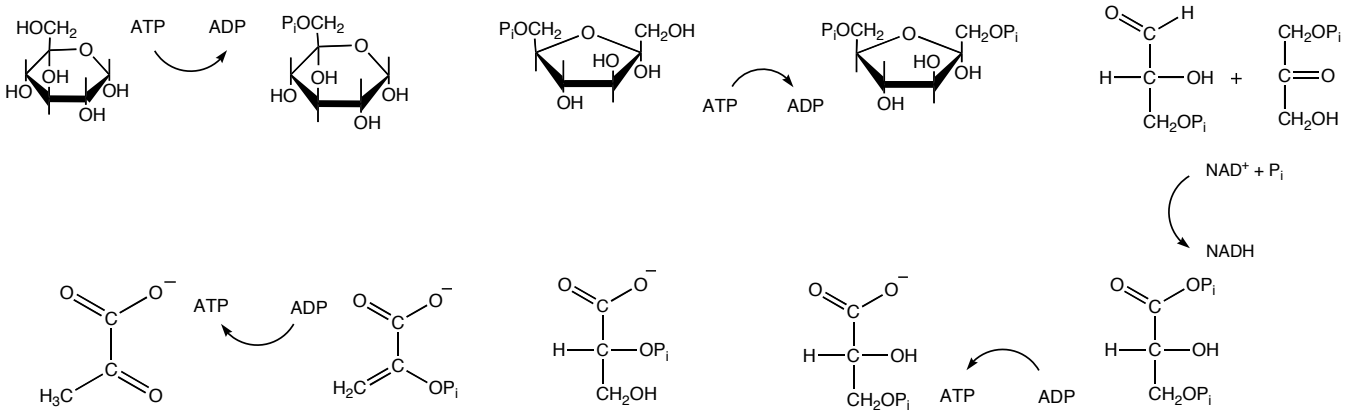
8. (8 pts.) The primary goal of the electron transport chain is to do what?

9. (8 pts) The antioxidant β-carotene is drawn below. Explain why it is good at preventing radical damage to membranes.



β-carotene

Glycolysis



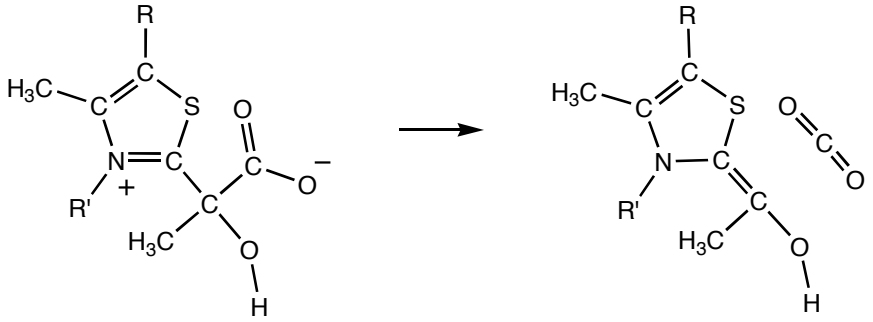
10. a. (10 pts.) Gluconeogenesis is, basically, glycolysis run in reverse, but there are three important steps where glycolysis cannot run in reverse. Add reaction arrows for the glycolysis reactions drawn above. Remember to use equilibrium arrows and irreversible arrows to indicate which reactions are reversible and which aren't.

b. (9 pts.) Explain what makes each of the irreversible reactions irreversible.

c. (4 pts.) For one of the irreversible reactions above (pick one) describe a how gluconeogenesis goes around the reaction.

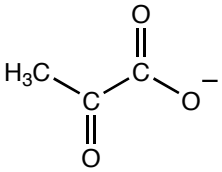
11. Pyruvate decarboxylase catalyzes the decarboxylation of pyruvate as drawn below.

a. (4 pts.) Add electron movement arrows to show how the products form from the reactants.

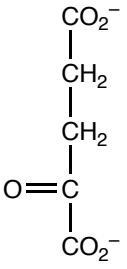


b. (6 pts.) α-Ketoglutarate bonds to thiamine pyrophosphate (TPP) in the same way that pyruvate bonds with TPP. Draw the structure of TPP bound to α-ketoglutarate (the structures of pyruvate and α-ketoglutarate are provided at the bottom of this page).

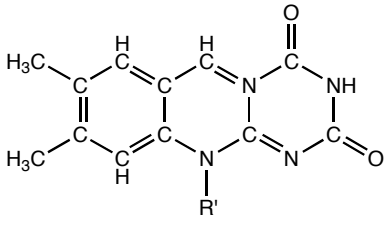
c. (6 pts.) Once bound to TPP α-ketoglutarate reacts like pyruvate reacts. Draw the products of the decarboxylation of α-ketoglutarate.



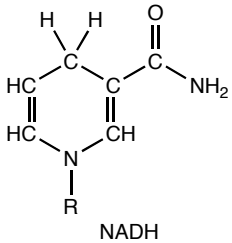
pyruvate



α-ketoglutarate

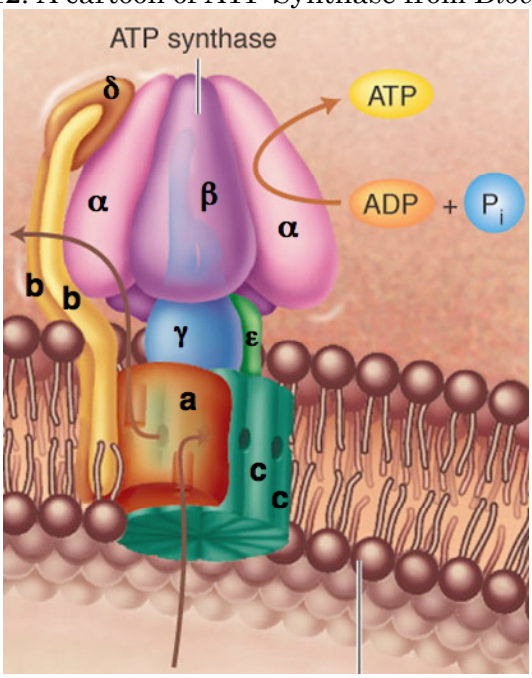


FMN



NADH

12. A cartoon of ATP Synthase from *Biochemistry* by McKee and McKee is pictured below.

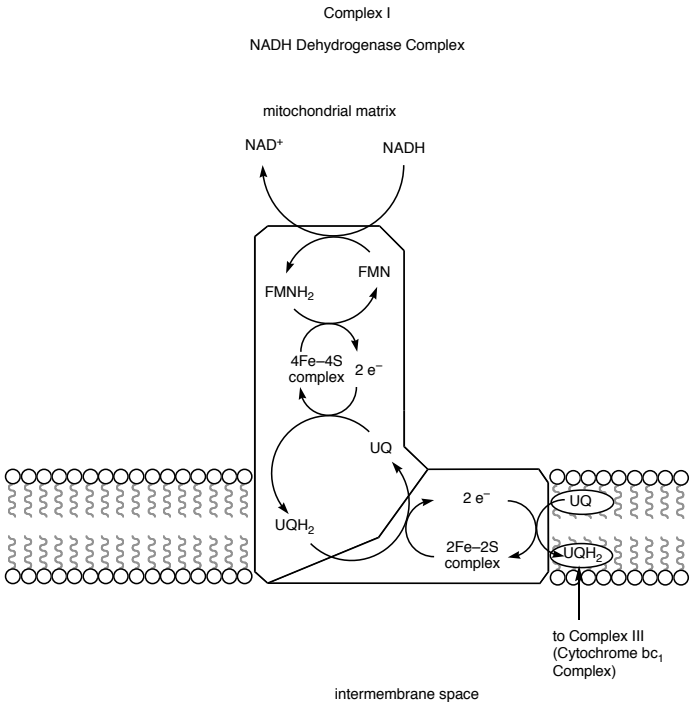


a. (b pts.) Which subunits move (list them by letter here)?

b. (6 pts.) Which subunits are stationary (list them by letter here)?

c. (6 pts) Which side of the drawing represents the matrix of the mitochondrion?

13. An incomplete graphical representation of the NADH Dehydrogenase Complex is drawn below.



a. (6 pts.) What is the bound UQ–UQH_2 cycle doing as it switches between oxidized and reduced states. (Identify the oxidized and reduced states.)

b. (6 pts.) NADH brings 2 e^-'s to this complex. Where do these electrons end up?

c. (6 pts.) In the first step, NADH transfers 2 e^-'s to FMN instead of transferring the e^-'s to the Fe–S complex. Why, does FMN act as an intermediate; that is, why doesn't NADH (structures of NADH and FMN are provided on the previous page.)