MCB 11 Problem Set 4 Key April 7, 2006

1. -- NADH- Reduced NAD indicates oxidation has taken place to provide electrons and protons for NAD reduction.
---CO_2- fully oxidized carbon which originated as C-OH (alcohol level) or >C=O (aldehyde level) carbons of glucose.

2a. niacin--a vitamin that must be eaten because it cannot be synthesized in our bodies. Is converted to coenzyme form NAD to assist in oxidation reactions, picking up the two electrons and protons from the metabolic intermediates that are oxidized, and becoming NADH + H^+.
b. FAD--coenzyme form of the vitamin riboflavin. Used in oxidation reactions to pick up the two protons and two electrons from oxidized metabolic intermediates to become $FADH_2$. Ultimately reoxidized by giving two electrons and two protons to the electron transport chain.

3. Not growing because all carbon ingested is excreted as CO_2. Intermediate compounds in the pathway need to be diverted to become starting materials for pathways to make amino acids, lipids, carbohydrates for growth.

4. Fermenters use the NADH to reduce pyruvate to either lactate or ethanol. In this reaction, NADH is reoxidized to NAD.

5. This is an isomerization. The starting material and product have the same number of each type of atom, but they are arranged differently.

6a. The PEP->pyruvate reaction results in the production of a molecule of ATP. A molecule of ATP is required in the second reaction listed. In effect the production of ATP in the first reaction is providing energy for the second reaction so that it is said that the second is driven by the first.
b. This can be thought of as efficient since the ATP used to start the pathway is regenerated later in that same pathway. It could be said to be inefficient in that 14 kilocalories are released in the first reaction but only three or four are needed to drive the second reaction. On the other hand, the "unused" energy pushes the equilibrium of both reactions to the side of the desired products.

7. group transfer and isomerization
a. group transfers: glucose to glucose-6-phosphate
fructose-6-phosphate to fructose-1,6, bis phosphate
1,3, phosphoglyceric acid to 3 phosphoglyceric acid
phosphoenolpyruvate to pyruvate

isomerizations: glucose-6-phosphate to fructose-6-phosphate
dihydroxyacetone phosphate to glyceraldehyde-3-phosphate
b. Most like isomerizations such as glucose-6-phosphate to fructose-6-phosphate. In both cases, atoms or groups of atoms are exchanged between different portions of the **same** molecule.