Exam 3 Review Session Problems

The Exam:

FRIDAY, April 25, 2003, 9:30-10:55am, Walker Memorial
Open notes, but NO old tests/bible material and no books/copies.
This means NO Professor Brown Practice Sets (and/or solutions)!!!

Do the PSETS & My Practice Sets!

Break Down Your Studying:

Enzyme Mechanism Sheets:
- Mechanism of Aldolase
- Mechanism of Isomerase and Mutase
- Arsenate: The Glycolysis Poison
- Enzymes of the TCA Cycle
- The Many Enzymes of Pyruvate
- Pyruvate Oxidase Particle

Other Handouts:
- Carbohydrates: Rings and Naming
- The Common Carbohydrates
- Those Pesky Co-Enzymes
- Coupling and Counting ATP

Your Charts should already include:
- Glycolysis
- Making and Breaking Glycogen
- Many Fates of Pyruvate
- Sugars and Their Metabolism
- TCA Cycle
- in addition you should have:
  - Gluconeogenesis
  - Glyoxylate Cycle
  - Where reactions take place - mitochondria vs. cytoplasm

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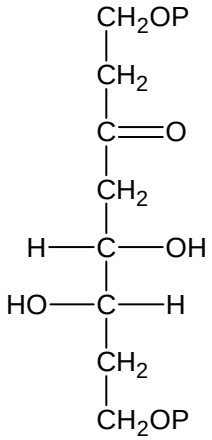
QUESTION 1 (Exam 2, 2001, Question 2, 15 points)

With the use only of specific enzymes discussed in class, show how mannose-6-P could be produced from glucose-6-P. In giving your answer, use structural formulas and show reaction mechanisms.

QUESTION 2 (Exam 2, 2001, Question 4, 20 points)

What two four-carbon compounds could serve as substrates for the production of the 8-carbon compound shown, in the presence of a single enzyme? Please use structural formulas and give the mechanisms for the reaction. Please include any proposed enzyme-bound intermediates that may be involved. *Hint: The enzyme has a Lysine residue at the active site.*



QUESTION 3 (Exam 2, 2001, Question 4, 20 points)

Show how liver tissue could metabolize pyruvate to succinate in the presence of sodium arsenite and plentiful supplies of ATP and reduced coenzymes. What compound would accumulate in this system when no reduced coenzymes are available and acetyl CoA is provided along with pyruvate and arsenite? Please explain how you arrived at your answers. (No structural formulas are required.)

QUESTION 4 (Exam 2, 2001, Question 6, 20 points)

Show how 3 pyruvates can be converted to 3 CO_2 and one citrate by a microorganism. Note that there is no net use or accumulation of any compounds other than citrate; that the concentration of ATP is relatively high in the system; and that no CO_2 (or HCO_3^-) fixation takes place. Additional information: operation of this set of enzymatic reactions under aerobic conditions results in the formation of 17 mols of ATP per 3 moles of pyruvate used, assuming 3 ATP are produced per mol of NADH oxidized and 2 ATP from oxidation of FADH2. In giving your answer, account for the production of the ATPs. (There is no need to give structural formulas unless you choose to do so.)

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QUESTION 5 (Old Problem Set)

A. A rat liver tissue can convert 0.002 M malate to 0.001 M succinate in the presence of 0.4 M malonate under aerobic conditions. Please give the set of enzymatic reactions that account for this transformation and how much net ATP could be generated. No structural formulas are required.

B. Arsenite and 0.002 M acetyl CoA are added to the reaction. Malate and acetyl CoA are metabolized completely. What would be the products and how much of each would be formed? Please give the enzymatic reactions to account for your answer. No structural formulas are required.

C. The reaction is now carried out as in part (a) but in the presence of a high concentration of ATP relative to ADP. The malate is now completely converted into glucose-6-P. What is the final concentration of glucose-6-P? Please give the set of enzymatic reactions that account for this transformation. No structural formulas are required.

QUESTION 6 (Exam 2, 2000, Question 3, 30 points)

Assume that liver cells metabolize 0.002 M glyceraldehyde-3-P under aerobic conditions in the presence of 0.1 M malonate. What would the products be and how much of each would be formed? How much net ATP could be produced in this system? How would the system be changed (products formed and ATP produced) if 0.002 fumarate is also added to the system? Please show how your answers were obtained (no formulas are necessary). Note: assume that aldolase does not function.