Professor Brown Practice Set 1

1. (Exam 2, Q3, 1999)

Suppose that in the liver, the enzyme phosphoenolpyruvate carboxylase, functions for the formation of oxaloacetate. What would the other substrates and products be? With the use of structural formulas, give the mechanism of this enzymatic reaction.

2. (Exam 2, Q4, 1999)

A. In the presence of O2 and arsenite (not arsenate!), liver tissue was observed to metabolize 0.002 M fumarate and 0.002 M acetyl CoA completely. What would the products be and how much of each product would be formed? Please give the enzymatic reactions to account for your answer (no formulas are necessary). How much ATP could be produced during this transformation? Hint: arsenite reacts with dimercapto compounds.

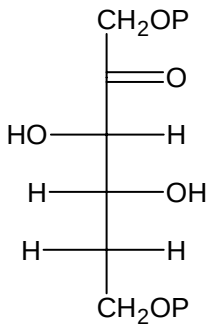
B. What would the products be if arsenite and acetyl CoA are deleted from the incubation mix and 0.4 M malonate is added? Please show how your answer was obtained (again, no formulas are necessary). How much ATP could be generated?

3. (Exam 2, Q5, 1999)

Under aerobic conditions a bacterial species was shown to metabolize completely 0.002 M pyruvate in the presence of 0.1 M malonate and under conditions in which isocitrate dehydrogenase is inoperative. What would the products be and how much of each would be formed? How much ATP could be formed? Please show how your answer was obtained (no formulas are necessary).

4. (Exam 2, Q2, 1998)

Show how the compound shown below could be produced from lactate and another 3-carbon compound in the presence of a series of enzymes that are involved in gluconeogenesis. Write the structure of the other 3-carbon compound. Assume the presence of a sufficient amount of nucleoside triphosphates. Give the mechanisms (with the use of structural formulas) for those enzymatic reactions in which enzyme-bound covalent intermediates are produced. For any other reactions it is sufficient to give the names of the reactants and the products. Note that the enzyme aldolase is not specific with regard to substrates utilized.



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5. (Exam 2, Q3, 1998)

Give the reaction sequence that would allow the overall enzymatic transformation indicated by the following reaction. Note that both (glucose)n and (glucose)n+5 refers to glycogen.

Sucrose + lactose + mannose + (glucose)n –> (glucose)n+5

In presenting your answer, assume the presence of adequate amounts of nucleoside triphosphates. You are not required to use structural formulas, but be sure to name the reactant(s) and product(s) for all of the proposed enzymatic reactions in the sequence. Use only those enzymes that have been discussed in class. Indicate how many ATP's are needed to allow the overall transformation to occur.

6. (Exam 2, Q4, 1998)

A microorganism is known to be able to carry out the following overall enzymatic transformation under aerobic conditions and with a relatively high cellular ratio of ATP to ADP.

3 pyruvate –> 3 CO_2 + citrate

Give the individual enzymatic reactions (no structural formulas needed) that account for this transformation. Use only enzymatic reactions that have been discussed in class. Please note that is CO_2 produced but no CO_2 is utilized. How many ATP's could be produced in this process?