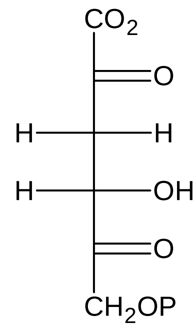
Professor Brown Practice Set 2

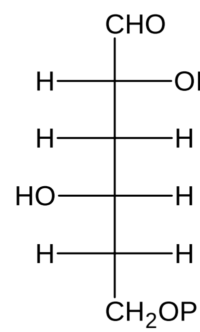
No the numbering is not messed up - I used some of these problems in your recitation this year so I removed them from this practice set.

3. (Exam 2, Q4, 1996) Assume that the hypothetical compound shown below can be converted to 2 moles of pyruvate under anaerobic conditions and in phosphate buffer. Propose a set of enzymatic reactions (similar to those involved in glycolysis) that could account for this transformation. Please give the structural formulas for proposed intermediates in the reaction sequence.



4. (Exam 2, Q5, 1996) Assume that a bacterial species that is missing the enzyme isocitrate dehydrogenase can, under aerobic conditions, convert 0.004 M pyruvate to 0.006 M CO_2 and 0.001 M glucose-6-P in the presenced of adequate amounts of inorganic phosphate and ADP. Give the set of enzymatic reactions that account for this transformation and indicate how much net ATP could be generated from the overal transformation. Please note that CO_2 is produced, but no CO_2 is used (i.e. no carboxylation reactions occur). The only compounds that are used in substrate quantities are pyruvate, ADP, and Pi. Any other compounds that may be needed must be regenerated in subsequent reactions. No structural formulas are required but be sure to indicate which, if any, coenzymes may be needed for individual enzymatic reactions.

5. (Exam 2, Q1, 1995) Assume that the compound whose structure is shown below can be converted to two 3-carbon compounds by the action in sequence of two enzymes. What would the products be and show how they could be made by indicating how each enzyme functions. Please use structural formulas and indicate mechanisms, including any proposed enzyme-bound intermediates. Where in the products would ^{18}O be found if these enzymatic reactions were allowed to proceed in the presence of ^{18}O-labeled H_2O? Please use only enzymes of the type discussed in class.



6. (Exam 2, Q2, 1995) How many net moles of ATP could be made per mole of succinate formed in the conversion by liver tissue of 0.002 M glyceraldehyde-3-P to 0.001 M succinate in the presence of 0.04 malonate and air. Please show how your answer was obtained.

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7. (Exam 2, Q3, 1995) Draw the structure of the following compound:

α-D-galactopyranosyl-(1 –> 5)-α-D-ribofuranosyl-(1 –> 1)-β-D-mannopyranoside.

8. (Exam 2, Q5, 1995) Show how a bacterial species can carry out the following overall metabolic transformation in the presence of air:

4 Acetate —> Glucose-6-P + 2 CO_2

How many net moles of ATP could be made in this overall transformation? Please include in your answer all proposed intermediates (structural formulas not needed) and reactions catalyzed by enzymes discussed in class. Keep in mind that acetate, ATP, ADP, Pi, and air are the only substances supplied in substantial amounts. Other compounds may be presence in catalytic amounts (i.e. if they are used they must be regenerated later in the reaction sequence).

9. (Exam 2, Q4, 1994) Assume that an organism can enzymatically convert glucose-6-P to mannose-6-P. Show how this might be done enzymatically without the participation of an "epimerase." Hint: two enzymes are involved, one of which is "hexose-P isomerase."

10. (Exam 2, Q5, 1995) Explain how a high concentration of ATP stimulates gluconeogenesis. Note: A complete answer should include a consideration of reactions in the TCA cycle as well as glycolysis.