Chem 352, Fundamentals of Biochemistry
Lecture 8 – Supplemental Questions

1. There are three reactions in glycolysis for which alternative reactions are used in gluconeogenesis.

   a. What is the function of glycolysis?

   b. What is the function gluconeogensis?

   c. Name the three reactions in glycolysis that are not used in gluconeogensis:
   i)

   ii)

   iii)

   d. Using structural formulas for the intermediates, write a balanced chemical equation for one of these reactions:

   e. What is the enzyme classification for this reaction? _____

   f. Describe how this reaction is *allosterically* regulated to meet the needs of the cell.

2. The glycolytic pathway contains a single dehydration reaction. *Using structures*, write a *balanced chemical reaction* for this reaction, *label* the glyclolytic intermediates and *name* the enzyme that catalyzes this reaction.

3. The *pentose phosphate pathway* has both an oxidative and a non-oxidative phase. Discuss the purpose of each phase and describe how they can be used in conjunction with glycolysis and gluconeogenesis to meet various needs for the cell.

4. Write a *net balanced chemical equation* for the *oxidative phase of the pentose phosphate pathway*, starting with glucose-6-phosphate and ending with ribulose-5-phosphate:

Cellular location: _____

5. Write a *net balanced chemical equation* for the *Gluconeogenesis*, starting at pyruvate and ending with glucose:

Cellular location: _____

6. Even though the citric acid cycle is not directly linked to the synthesis of ATP by *ATP synthase*, the two process are tightly regulated; if there is inadequate ADP for the synthesis of ATP by *ATP synthase,* the entry of material into the citric acid cycle for catabolic purposes is blocked by inhibiting the synthesis of pyruvate by *pyruvate kinase*. Describe how this regulation occurs by tracing the steps back from an inadequate quantity of ADP for ATP synthesis by *ATP Synthase* to the inhibition of pyruvate synthesis be *pyruvate kinase*, with a focus on the steps that are blocked and the metabolites that accumulate.

7. Draw a representative structure for glycogen:

a. Explain how the skeletal muscles and the liver have a different purpose for storing glycogen.

b. Describe how the hormones *glucagon*, *epinephrine* and *insulin* are used to regulate glycogen metabolism to meet needs of the organism.

8. Pyruvate is the end product of glycolysis.

a. Using words, describe three possible fates for the pyruvate. Indicate the purpose for each.

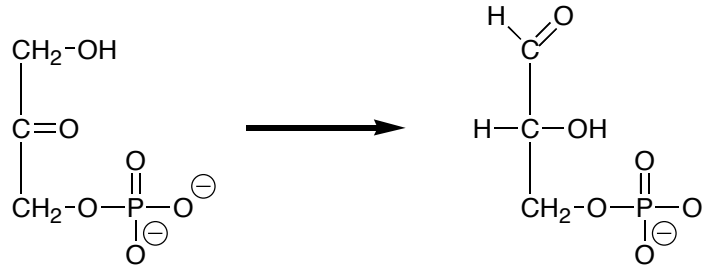
i)

ii)

iii)

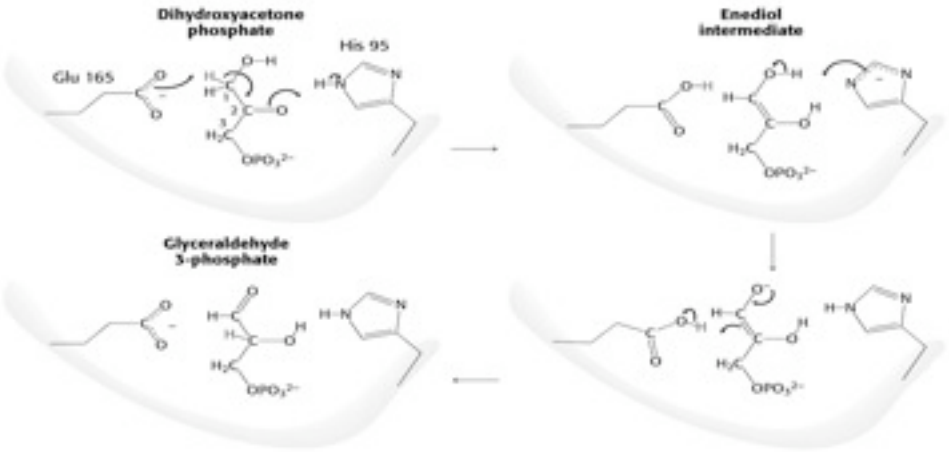
b. Using structural formulas draw a balanced chemical equation that illustrates one of these fates.

9. Below is a figure that shows a representation of the active site of an enzyme found in the glycolytic pathway. The reaction carried out by this enzyme is



Dihydroxyacetone phosphate

Glyceraldehyde 3-phosphate



a. What class does this enzyme belong to? _____
(By "class", what is meant is, is this enzyme an *oxidoreductase*, *lyase*, *isomerase*, *ligase*, *transferase*, or *hydrolase*; pick one.)

b. Describe the role played by the glutamic acid side chain (Glu 165) in this reaction:

10. Your textbook defines substrate-level phosphorylation as "the synthesis of ATP from ADP by phosphorylation coupled with the exergonic breakdown of a high-energy organic substrate molecule." There are two substrate-level phosphorylations in glycolysis and one in the citric acid cycle. *Draw the structure* and *name* the high-energy organic substrate that is used in each reaction.

Structure	Name	Pathway

11. There are two ways that pyruvate, the end product of glycolysis, can enter the citric acid cycle. Using structures to represent the intermediates, write a balanced chemical equations for each of these, and describe the purpose for each:

a.

Purpose:

b.

Purpose: