Name Key

Chem 352 - Spring 2011
Quiz 4

1. The word "gluconeogenesis" translates as "to create new sugar".

   a. In mammals, what organ is the primary site for gluconeogenesis? The liver

   b. What is the primary purpose for having this organ synthesize new glucose?
   The liver's primary purpose for synthesizing glucose is to release it into the blood to supply other tissues with the glucose they require. The liver does not require glucose for its energy needs and is one of the very few organs that is able to release glucose into the blood. The liver synthesizes glucose using such starting materials as lactate from the muscles, amino acids from degraded proteins, and glycerol from fats. It obtains the energy required for the synthesis from the degradation of fatty acids.

   c. The final reaction in glycolysis is catalyzed by the enzyme *pyruvate kinase* and converts phosphoenolpyruvate to pyruvate. Under physiological conditions, this reaction has a very high negative free energy change, therefore, converting pyruvate back into phosphoenolpyruvate in gluconeogenesis requires an alternative pathway. Using *structural formulas* for the reactants, products and intermediates, write the *balance chemical equations* for the two reactions in this pathway.

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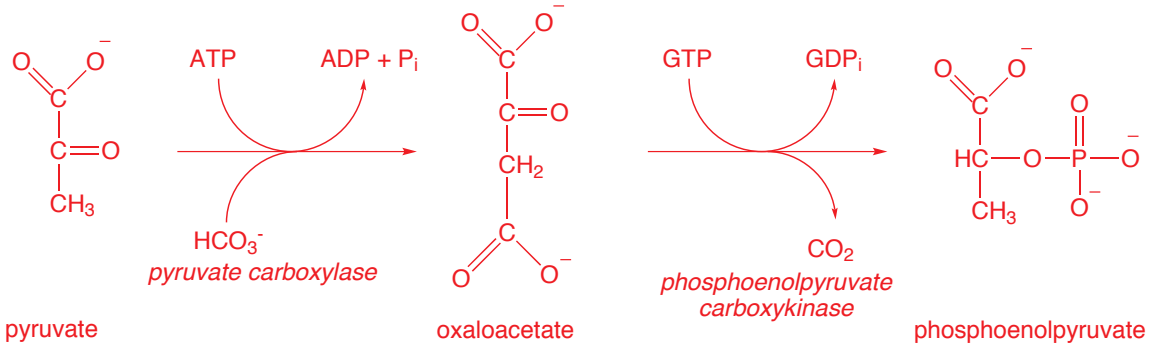

   d. What are the names of the enzymes that catalyze the two reactions described in c?

      i. pyruvate carboxylase

      ii. phosphoenolpyruvate carboxykinase

   e. What is the sources of free energy used to drive this reaction? The hydrolysis of ATP and GTP.

   f. What citric acid cycle intermediate is also involved as an intermediate in the conversion of pyruvate to phosphoenolpyruvate? oxaloacetate

2. In its catabolic mode, the citric acid cycle is used to oxidize the equivalent of the two carbons that enter the cycle as acetyl-CoA and releases them as CO_2.

   a. Using *structural formulas* for the reactants and products, write the balanced chemical equation for *one* of the oxidoreductase reactions in the citric acid cycle:

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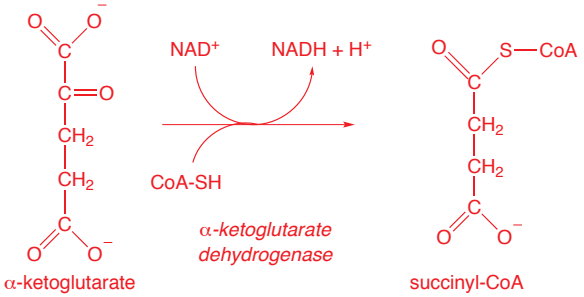

Other options include
- *isocitrate dehydrogenase*
- *succinate dehydrogenase*
- *malate dehydrogenase*

Though tied to the citric acid cycle, the pyruvate dehydrogenase reaction is not in the citric acid cycle.

   b. What is the name of the enzyme that catalyzes the reaction you chose in a? α-ketoglutarate dehydrogenase

3. The oxidative stage of the pentose phosphate pathway is used to convert a glycolytic intermediate to a pentose and at the same time produce reducing agents for biosynthetic reactions.

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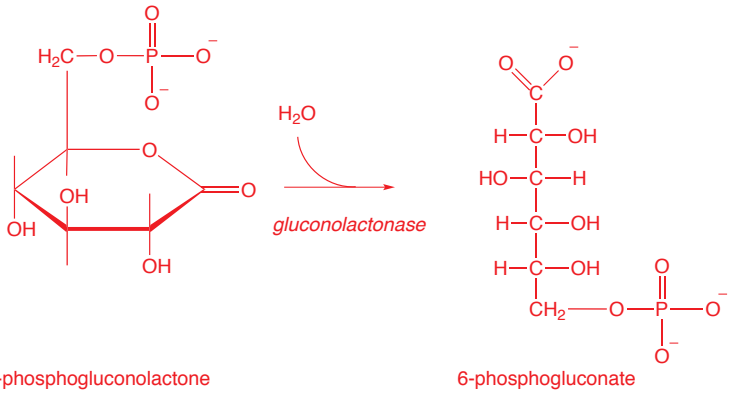
   a. Which glycolytic intermediate is the starting point for the oxidative stage of the pentose phosphate pathway? glucose 6-phosphate

   b. What is the name of the pentose produced? ribulase

   c. What reducing agents are formed? NADPH + H+

   d. Besides two oxidoreductase reactions, the oxidative stage also contains a hydrolase reaction. Using *structural formulas* for the reactant and product, write the *balanced chemical equation* for this reaction.



   e. If the pentose produced in the pentose phosphate pathway is not required by the cell, what two glycolytic intermediates is it converted to by way of the non-oxidative stage of the pentose phosphate pathway?

      i. fructose 6-phosphate (2x)

      ii. glyceraldehyde 3-phosphate)

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