Name _____

Chem 352 - Spring 2011 - Exam III

1. Draw the structure of the membrane phospholipid *phosphotidylcholine* containing a stearyl (18:0) acyl group at the C1 position a palmitoleyl (16:1, cis-Δ9) acyl group at the C2 position.

   a. Fats and oils derived from animals and plants sources comprise triacylglycerols. Oils are typically liquid at room temperature, whereas fats, such as butter and lard, are solids at room temperature. Make a claim based on this evidence about the differences in composition for triacylglycerols found in oils *versus* fats.

2. Using names (not structures) for the reactants and products, write a *net balanced* chemical equation for the following pathways that are involved in carbohydrate metabolism.

   a. glycolysis:

   b. gluconeogenesis:

   c. the oxidative stage of the pentose phosphate pathway:

   d. A combination of glycolysis, the pyruvate dehdrogenase reaction, the citric acid cycle and the electron transport chain.

3. Out of the 10 reactions in glycolysis, there is just one that is catalyzed by an oxidoreductase.
   a. Use *structural formulas* for the pathway intermediates to write the *balanced chemical equation* for this reaction:

   b. What is the name for the enzyme that catalyzes this reaction? _____
   c. What is the oxidizing agent used in this reaction? _____
   d. Use *structural formulas* for the pathway intermediates to write the *balanced chemical equation* for the reaction that is used human muscles when oxygen is not available to re-oxidize the oxidizing agent that is reduced in the reaction shown above.

4. When oxygen is available and can be utilized, a large number of equivalents of ATP can be produced by combining the citric acid cycle with glycolysis to oxidize the carbon atoms found in glucose all the way to CO_2.
   a. Use *structural formulas* for the pathway intermediates to write the *balanced chemical equation* for one of the reactions in the citric acid cycle that releases a CO_2.

   b. What is the name of the enzyme that catalyzes the reaction you chose in a? _____
   c. While the citric acid cycle allows approximately 32 equivalents of ATP can be produced from the complete oxidation of glucose, only two equivalents are made directly in the citric acid cycle. Use *structural formulas* for the pathway intermediates to write the *balanced chemical equation* for the one reaction in the citric acid cycle that uses substrate level phosphorylation to produce an equivalent of ATP.

   d. What is the name of the enzyme that catalyzes the reaction shown above? _____
   e. If it is not the citric acid cycle, where are the bulk of the ATP equivalents synthesized? _____

5. Glucose 6-phosphate in the cytosol sits at a metabolic crossroads.
   a. For a liver cell, identify three different pathways that lead *away* from glucose 6-phosphate and describe the metabolic role that each plays:

      i.

      ii.

      iii.

   b. Use *structural formulas* for the pathway intermediates to write a *balanced chemical equation* for the *first* reaction in each pathway identified above. Indicate the names of the enzymes that catalyze each reaction as well the names of the reactants and products.
      i.

      ii.

      iii.

6. For each of the complexes in the electron transport chain, identify the initial donor (reducing agent) and final acceptor (oxidizing agent) of electrons:

Complex	Electron Donor	Electron Acceptor
I		
II		
III		
IV		

   a. Where in a eukaryotic cell is the electron transport chain located? _____

   b. Which of the four complexes couples oxidation/reduction to tranporting protons across the inner mitochondrial membrane? *Circle all that do*.

   I II III IV

   c. Name two mobile electron carriers that are involved in the electron transport chain and indicate whether they are a one-electron carrier, a two-electrons carrier, or either:

Carrier	*One electron*, *Two electron*, or *Either*

7. Then enzyme phosphofructokinase 1 (PFK-1) catalyzes the first committed step in glycolysis and is therefore regulated by a number of allosteric effectors. Identify whether each of the following allosteric effectors for PFK-1 *activates* or *inhibits* PFK-1 activity. Also indicate the cellular or systemic needs that each is signaling:

   a. AMP:

   b. ATP:

   c. Citrate:

   d. Fructose 2,6-bisphosphate:

Extra Credit:

a. Ask the a question that you anticipated me asking, but I failed to do so. (Up to 2 points will be awarded for an insightful, probing and well-worded question.)

b. Answer the question you posed in part 1. (Up to 1 point will be awarded for answering your question correctly.)

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