Name _____

# Chem 352 - Spring 2009 - Exam II

1. Draw the structure of the phosphotidylserine molecule that contains two palmitoleate (16:1, $\Delta^9$) acyl groups.

   a. Which phospholipid would better suit a cold-blooded organism for survival in an artic environment, the molecule that you drew above, or a phosphotidylserine containing two palmitate (16:0) acyl groups, Explain your answer.

2. When red-blood cells are treated extensively with protease most membrane proteins are broken down into small peptides. However, some proteins are very resistant to this treatment. If cleavage by protease is the only type of reaction that occurs in this treatment, how could this be explained?

3. (Circle one) Facilitated diffusion (passive transport) through a biological membrane is
   a. generally irreversible.
   b. driven by the hydrolysis of ATP.
   c. driven by a concentration gradient.
   d. endergonic.
4. (Circle one) The primary purpose of the fermentation pathways are the
   a. oxidation of NADH + $H^+$.
   b. production of ADP.
   c. consumption of $O_2$.
   d. generation of a proton gradient across mitochondrial inner membrane.

5. Mitochondrial ATP synthase converts ADP and $P_i$ to ATP. The ATP produced from this reaction must then be transported out to the cytosol, where it is used to drive biosynthetic reactions. In order to sustain this process, the ADP and $P_i$ that are produced in the cytosol must be transported back into the mitochondria where ATP synthase converts them back into ATP. The transport of ATP, ADP and $P_i$ across the inner mitochondrial membrane provide good examples of both a *symport* and an *antiport* active membrane transport systems. Describe each example and indicate the source of energy used to drive the transport.

   a. The symport system:

   b. The antiport system:

6. Pyruvate, the end product of glycolysis, can enter the citric acid cycle by two different paths, one for catabolic purposes and the other for anabolic purposes. Using structural formulas for the intermediates, write a balanced chemical equation for each of these paths, each which leads from pyruvate to a citric acid cycle intermediate. Indicate the names of the enzymes that catalyze each of reactions in these paths.

   a. Catabolic path:

   b. Anabolic path:

c. Among the enzymes that you named in parts a and b, there are six different coenzymes. Name and describe the catalytic activity for four of these:

i.

ii.

iii.

iv.

7. The oxidative stage of the pentose phosphate pathway produces both NADPH + $H^+$ and ribulose 5-phosphate.

a. Describe the primary purpose for each of these products:

i. NADPH + $H^+$:

ii. ribulose 5-phosphate:

b. Using structural formulas for the intermediates, write a balanced chemical equation for the oxidative stage of the pentose phosphate pathway.

c. Describe the options available to a cell if it needs NADPH + $H^+$ but not ribulose 5-phosphate.

8. For each of the complexes in the electron transport chain, identify the initial donor and final acceptor 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 complex pump protons across the inner mitochondrial membrane?

_____

c. Name four electron carriers that are involved in the electron transport chain and indicate whether they are one-electron, two-electrons carriers, or both:

| Carrier | One electron, Two electron, or Both |
|---|---|
| | |
| | |
| | |
| | |

9. Describe how the synthesis of ATP is coupled to transferring electrons down the electron transport chain.

10. Fructose 2,6-bisphosphate is an allosteric effector for enzymes in both the glycolytic and gluconeogenesis pathways. This metabolite is not an intermediate, product or substrate for either of these pathways.

    a. Name an enzyme in the glycolytic pathway that is regulated by fructose 2,6-bisphosphate _____. Is it serving as an *activator* or *inhibitor*? _____

    b. Name an enzyme in the gluconeogenesis pathway that is regulated by fructose 2,6-bisphosphate _____. Is it serving as an *activator* or *inhibitor*? _____

    c. Describe how fructose 2,6-bisphosphate is produced, and what its presence of absence is signaling.

11. Both the muscles and the liver can synthesize glycogen from glucose

    a. What is the biological function for glycogen?

    b. The muscles and the liver synthesize glycogen for different purposes. Describe these

        i. Muscles:

        ii. Liver:

Extra Credit:

1. Ask the one question that you wanted me to ask, but I did not ask. (1 point will be awarded for an insightful, probing and well-worded question, which I can use on the Final Exam.)

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