CHEM 440 Exam 2 10 Nov 2008 /100 Name ____________________________

Please do the easiest first; ask for clarification of any question.

1. (4) List two biological functions of carbohydrates (any form).

a. b.

2. (2) *fill in the blanks:* With respect to motion in cell membranes, most embedded proteins can move freely relative to each other in the ________________________________ direction but cannot move in the ________________________ direction.

3. (2) Draw the predominant structure of fructose-6-phosphate.

4. (3 each) Define clearly and concisely:

a. anabolism

b. ion carrier

5. (6) Describe two ways that phosphorylase kinase can be activated, plus how each kind of activation can be reversed. Reaction that it catalyzes is available for a 1-point penalty.

	Method 1	**Method 2**
Activate:		
Deactivate:		

6. (10) Compute the biochemical standard free energy change for movement of one mole of Na^+ ions from compartment A to compartment B. $[Na^+]_A$ = 15 mM; $[Na^+]_B$ = 5 mM; T = 25 °C; $\mathscr{F}$ = 96485 coul/mol; R = 8.3 J/mol•K; compartment B has a potential Ψ of **negative** 60 mv (-60 mv) relative to A; 1 v = 1 J/coul.

7. (8) Hexokinase (which catalyzes the reaction glucose + ATP → G6P + ADP) is inhibited by elevated concentrations of G6P but is not much affected by the [ATP]/[AMP]. Explain why this makes sense, considering the possible fates of G6P.

8. To an extract of liver cells supplied with ample ATP but no O_2, you add **5.0 µmoles of lactate** labeled at its **methyl carbon** with ^{14}C at **2000 cpm/µmole**. Assume that the extract uses lactate only for gluconeo-genesis. Answers to the following questions must contain enough detail to clearly illustrate your logic.

a. (8) At what **position(s)** and at what **specific radioactivity** would the produced G6P carry ^{14}C?

b. (4) How many µmoles of ATP would be consumed in converting all the lactate to G6P? Show logic in work for (a).

c. (12) Suppose that all the G6P made by the extract is consumed by the 6-phosphogluconate path, and suppose further that you can prevent consumption of ribose-5-P (thus making it the end product). In what **compound(s)** would you find ^{14}C? At what **atom** of each? What would be the **specific radioactivity** of each labeled compound?

d. (6) What **other product** (in addition to ribose-5-P) that is useful to cells would result from the action of (c), and **how many µmoles** of it would be produced? Show logic in work for (c).

9. (6) Give 3 reasons why maintenance of a steady state is essential to maintenance of the living state.

a.

b.

c.

10.a. (2) Show the reaction catalyzed by **adenylate kinase**.

b. (10) Explain in detail why this reaction is useful to cells (reaction available for 2-pt penalty).

11. ATP is well suited to its role as a medium of energy exchange and supply in living systems.

a. (4) Tell why this is true based on the free energy of hydrolysis of ATP relative to free energies of hydrolysis of other phosphorylated compounds found in cells.

b. (4) Tell why this is true based on the chemical structures of ATP compared to its hydrolysis products.

12. (6) Choose **one** of the "pseudocycles" shown below. Tell how molecular traffic in both directions is regulated. Suggestion: make a table whose columns are the names of oppositely-directed enzymes (circled) and rows are names of regulator compounds.