Name_____

Use complete sentences when requested. There are 100 possible points on this exam. The multiple choice questions are worth 5 points each. All other questions have the points indicated.

Exam Memory Bank

$$V_0 = \frac{V_{max} \times [S]}{K_m + [S]}$$

$$V_{max} = k_{cat} \times E_t$$

$$k_{cat} = \frac{kT}{h} \times e^{\frac{-G^{\ddagger}}{RT}}$$

$$\Delta G = \Delta H - T\Delta S$$

$$\Delta G^{\circ\prime} = -nF\Delta E^{\circ\prime}$$

$$\Delta G^{\circ\prime} = -RT\ln K_{eq}^{\circ\prime}$$

$$\Delta G_t = RT\ln\frac{c_2}{c_1}$$

$$\Delta G_t = RT\ln\frac{c_2}{c_1} + ZF\Delta\psi$$

R = 8.314J/molxK

F = 96,500J/Vxmol

Boltzman constant, $k=1.381\times10^{-23}$ J/K

Plank's constant, $h=6.626\times10^{-34}$ Jxsec

Avogadro's number, 6.02×10^{23}/mol

$\ln x = 2.303\log_{10} x$

calorie=4.184J

1. (10 points) How do aquaporins work? How is their proposed structure related to their function?

2. (10 points) The liver has GluT2 transporters and they have a K_t value of 66 mM. Brain cells have GLUT 3 with a Kt value of 1mM and red blood cells have GLUT3 with a Kt of 5 mM. If blood glucose levels were 5 mM, which tissue would have the highest velocity of glucose uptake? Fully explain your reasoning.

3. (15 points) Compare and contrast ion channels with passive transporters. Give a specific example of each as you give a detailed explanation of their characteristics.

4. (5 points) Eggs have been wrongly accused of causing heart attacks! The body makes about a gram of cholesterol every day, so the amount obtained from eating an egg (200 mg) or two is not excessive. In fact, eggs are a very inexpensive source of a complete protein and thus should be included in most diets. In order to get cholesterol "out of jail" describe the functions and roles of cholesterol.

5. (10 points) If a mixture of triglyceride, cholesterol, and phosphatidylglycerol was dissolved in chloroform, then subjected to thin-layer chromatography on silica gel using a mixture of chloroform/methanol/water as the developing solvent, which would move fastest? Draw the silica gel plate and identify the spots.

6. (10 points) How do the toxins, tetrodotoxin, saxitoxin, dendrotoxin, bugarotoxin, tubocurarine, cobrotoxin exert their effects?

7. (5 points) Activation of a G protein-coupled receptor causes stimulatory G protein (Gs) to
A. replace its bound GDP with GTP.
B. dissociate from adenylyl cyclase.
C. hydrolyze GTP into GDP and Pi.
D. generate cGMP

8. (15 points) Describe the epinephrine signaling system as you answer these two questions:
   a. How is the signal amplified?
   b. How is the receptor desensitized and the signal terminated?

9. How does the AIDS virus enter cells? What is needed on the cell? What on the virus interacts with the cell it enters?

10. (10 points) Most cells have intracellular Na^+ concentrations of 10 mM, compared to the extracellular concentration of 120 mM.
    a. Calculate the Gibb's free energy change for the flow of Na^+ from the inside of the cell to the outside, for a cell with a membrane potential of 50 mV (negative on the inside).

    b. Is energy required for this process to occur?

    c. If energy is given off, suggest a potential use for this energy. If energy is required, suggest a potential source of energy.