NAME [redacted] (3) 2003 Student Number [redacted]

QUIZ 1 Corrected

Directions: Neatly fill in your name and Student number (**DON'T USE YOUR SOCIAL SECURITY NUMBER & REMEMBER YOUR STUDENT NUMBER !!**)

Problem(s): Calculate the answer to the problem & fill in at the space provided.

Single Choice: Circle the correct answer or Neatly write the letter corresponding to the correct answer next to the question.

1. Problem (1 Point):

A resting cell has the following membrane ionic conductances and equilibrium potentials. Use the transference equation to compute the cell's resting membrane potential.

Transference equation for this cell is: $E_m = T_K E_K + T_{Na} E_{Na} + T_{Cl} E_{Cl}$

Where: $T_K = \frac{g_K}{g_k + g_{Na} + g_{Cl}}$, $T_{Na} = \frac{g_{Na}}{g_k + g_{Na} + g_{Cl}}$ and $T_{Cl} = \frac{g_{Cl}}{g_k + g_{Na} + g_{Cl}}$

$\frac{5}{20+5+5}$

0.66 0.17 0.17

Ionic conductances, nanoSiemens			Equilibrium potentials, millivolts		
g_K	g_{Na}	g_{Cl}	E_K	E_{Na}	E_{Cl}
20 nS	5 nS	5 nS	-90 mV	+60 mV	-80 mV

$\frac{20}{20+5+5} = 0.66$ $\frac{5}{20+5+5}$

$E = (0.66)(-90mV) + (0.17)(+60mV) + (0.17)(-80mV)$

$-59.4 + 10.2 \& -13.6 = -62.8mV$

ANSWER -62.8 mv.

Single Choice (1/2 Point each):

2. If the absolute refractory period of a nerve is 2 milliseconds,

a. ~~the~~ nerve can be made to fire as many 600 action potentials per second.

b. you will **not be able** to make it fire another action potential 1 millisecond after the start of the first action potential.

c. ~~you~~ will **only** be able to make it fire another action potential 1 millisecond after the start of the first action potential **if** you use a supramaximal stimulus.

d. ~~its~~ Na^+ channels take at least 5 milliseconds to inactivate.

3. Which of the following solutions is isosmotic to a 145 mM NaCl solution? Assume that $\sigma = 1$ for all substances.

a. 145 mM sucrose.
b. 145 mM $CaCl_2$
c. 290 mM sucrose.
d. 290 mM $CaCl_2$.

4. The Cl^-/HCO_3^- exchanger in the red blood cell is an example of an electroneutral countertransporter system. Which of these statements is ***always* true** about this countertransporter system ?

a. For every (-) charge that enters the cell via the transporter, a (-) charge leaves the cell.
b. Two different solute molecules are both either transported into the cell, or are both transported out of the cell
c. ATP is hydrolyzed by the transporter to provide a direct source of energy for the movement of the ions.
d. Transport of one solute molecule (e.g., the Cl^-) can take place without the other solute (e.g., HCO_3^-) being present.

5. Proteins that embedded in the plasma membrane can be described as floating in a "sea of phospholipids".

a. True.,
b. False.

6. What will happen if you take a normal mammalian cell and place it in a solution whose K^+ concentration is equal to that of the cell's cytoplasm?

a. The cell's membrane potential will become more negative.
b. The cell's membrane potential will not change.
c. The cell's membrane potential will depolarize (go towards 0 mV).
d. The cell's membrane potential will become –90 mV.

7. At the peak of a nerve action potential, the Na^+ conductance (g_{Na})

a. is zero
b. is at its minimum value, but is not zero
c. is at its maximum value
d. is due to open K^+ channels