Name: __Answers_____

Biol 6102 Practice Questions

1) Fill in the missing values in the table. Assume that the temperature is 37°C. You probably will need a calculator for this. Round to the nearest 0.1

	Concentration (mM)		
Ion	**Intracellular**	**Extracellular**	**Nernst Potential**
K^+	400	20	-80.7 mV
K^+	140	10	-71.1 mV
K^+	140	5	-89.7 mV
K^+	140	140	0 mV
Na^+	50	440	58.6 mV
Na^+	10	145	72.0 mV
Na^+	10	100	62 mV
Ca^{++}	10^{-4}	10	310 mV
Ca^{++}	10^{-4}	1	248 mV
Cl^-	50	560	-65.1 mV
Cl^-	5	100	-80.7 mV
Cl^-	10	100	-62 mV

2) Use the Goldman Equation to calculate the resting membrane potential at 37°C for each case:

Ion	**Relative Permeability**	**Concentration (mM) Intracellular**	**Extracellular**	**Membrane Potential**
Squid Axon				
K^+	10	400	20	-57.5 mV
Na^+	1	50	440	
Cl^-	10	50	560	
Squid Axon with elevated extracellular [K^+]				
K^+	10	400	80	-46.1 mV
Na^+	1	50	440	
Cl^-	10	50	560	
Squid Axon with increased Na^+ conductance				
K^+	10	400	20	30.1 mV
Na^+	100	50	440	
Cl^-	10	50	560	
Mammalian Neuron				
K^+	10	140	5	-57.7 mV
Na^+	1	10	145	
Cl^-	10	10	110	

3) At 37°C, how much current would flow through potassium channels in a cell membrane under the following conditions if the conductance is 10 μS?

a) Potassium is 10x higher inside the neuron than outside and the resting membrane potential is -62 mV.

$I = G (V_m - E_K)$, $E_K = -62mV$, $I = 10 \times 10^{-6}$ S * (0 V) = 0 A

b) Potassium is equal on both sides of the membrane and the resting membrane potential is -62 mV.

$I = 10 \times 10^{-6}$ S * (-62×10^{-3}V – 0 V) = -620×10^{-9} A = -0.62×10^{-6} A = -0.62 μA

c) Potassium is 10x higher inside the neuron than outside and the resting membrane potential is 0 mV.

$I = 10 \times 10^{-6}$ S * (0 V - -62×10^{-3}V) = 620×10^{-9} A = 0.62×10^{-6} A = 0.62 μA

4) Plot the predicted results of a voltage clamp experiment measuring current 20mV intervals between –100mV and +60mV. The y-axis is current, the x-axis is holding potential. The answer for curve A is shown. Label each curve.

Curve A: A potassium current with a constant conductance of 100nS. E_K = -80mV
Curve B: A chloride current with a constant conductance of 200nS. E_{Cl} = -50mV
Curve C: A sodium current with a constant conductance of 50nS. E_{Na} = +50mV