1. (A) Why is the Na⁺/K⁺ ATPase pump considered electrogenic?  (B) What will happen in the short-term and long-term to the resting potential if the Na⁺/K⁺ ATPase pump is blocked?

2. Name four pieces of evidence that demonstrates the existence of chemical neurotransmission (Do not use the criteria for transmitter identification as your answer).

3. Define permeability and conductance. What is the difference between the two? Give a physiological example where the permeability to a given ion is high while the conductance of that same ion is zero.

4. While recording from crab muscle, you find that reducing the extracellular concentration of Cl- from 550 mM to 350 mM changes the reversal potential of an IPSP from -66.4 mV to -55 mV but the resting potential remains unchanged at -60 mV. What can you deduce about the ionic mechanisms of the IPSP and the resting potential? (58 log 550/350 = 11.4)
5. The cell to the right is stimulated to make an action potential at point A. When the action potential reaches point B, it (circle the single correct answer):

A. Goes to point C  
B. Stays at B  
C. Returns to A  
D. Goes to C and D  
E. Goes to A and D  
F. Goes to A and C  
G. Goes to C and D and returns to A

Explain your answer:

6. $E_{K+}$ in a normal neuron is -90mV. What would be the new value of $E_{K+}$ if:
   A) the intracellular concentration of $K^+$ was reduced to 10% of its original value?  
   B) the extracellular concentration of $Na^+$ was increased 10-fold?  
   C) ligand-gated $Cl^-$ channels were activated?  
   D) A single action potential was initiated? (Your answers should be precise and in mV)

7. You discover an unlabeled bottle on the chemical shelf and apply it to the neuromuscular junction preparation from which you are recording. There is an increase in the amplitudes of both the EPSP and the miniature EPSP. Where in the synapse is this chemical acting and how is it causing these effects?
8. You record a post-synaptic potential show below. What is the time constant (Tau) of the membrane of this cell (show your work)?

9. A depolarizing voltage clamp pulse is delivered to an axon being held at -70mv and the inward Na$^+$ and outward K$^+$ currents are recorded. If you want to eliminate the Na$^+$ current and record only the outward K$^+$ current, you have three ways of accomplishing this aim. Name all three. Assume you have control over the external solution and the voltage of the clamp pulse. Make certain that your procedures make the Na$^+$ current zero.

10. TRUE OR FALSE (enter answer on blank line):
A. The duration of an action potential is longer if the inward current carrier is Na$^+$ instead of Ca$^{2+}$. 

B. Capacitance is the inverse of resistance. 

C. The inactivation of voltage-dependent Na$^+$ channels is time-dependent. 

D. Opening of transmitter-dependent Cl$^-$ channels causes Vm to depolarize. 

E. The Nernst Potential for Na$^+$ is that membrane potential where there are equal amounts of Na$^+$ ions on both sides of the membrane. 

F. Post-synaptic potentials are passive potentials that decrement with distance whereas action potentials are active potentials whose amplitude remains relatively constant. 

G. Voltage-dependent Na$^+$ channels have 3 states: closed, half open and fully open. 

H. In the voltage clamp, current is held constant while membrane potential varies. 

I. The absolute refractory period limits the frequency of post-synaptic potentials. 

J. The acetylcholine receptor at the vertebrate neuromuscular junction is voltage dependent.