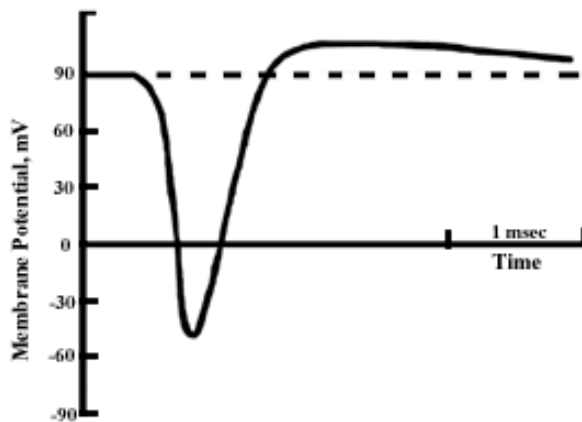


Cell Signaling

1. (12 pts) Remember the giant squid recorded Alice's Scientific Journal? These LGW (Looking Glass World) predators have complex muscular and nervous systems, and their excitatory cells (and surrounding fluids) exhibit the ionic concentrations (in mM) listed in the Table below. Trans Looking Glass monovalent ions differ from ours, and the ones commonly found in organisms on the other side are represented in the Table below:

<u>Ion:</u>	<u>M⁺</u>	<u>N⁺</u>	<u>O⁻</u>
Inside cells -	260	4	34
Outside cells -	10	290	300

Patch-clamping measurements indicate *stimulated* squid nerve and muscle cells exhibit striking changes in membrane potential as indicated below; these changes are called LAPs (or Looking-Glass Action Potentials). The resting membrane potential is +88 mV, and the log values for the ratio of the inorganic ions are indicated along the side. Alice found the temperature over there a uniform temperature of 298 °K



Logs of Concentration Ratios:

$$\begin{aligned}
 [M^+]_{in}/[M^+]_{out} &= 1.41 \\
 [M^+]_{out}/[M^+]_{in} &= -1.41 \\
 [N^+]_{in}/[N^+]_{out} &= -1.86 \\
 [N^+]_{out}/[N^+]_{in} &= 1.86 \\
 [O^-]_{in}/[O^-]_{out} &= -0.95 \\
 [O^-]_{out}/[O^-]_{in} &= 0.95
 \end{aligned}$$

Answer **all** the following questions, showing **all relevant calculations**.

A. (4 pts) How is the resting potential likely generated in these cells? Briefly explain the basis for your answer.

B. (4 pts) Describe the LAP and what changes in membrane properties likely produce its various features.

C. (4 pts) LAPs may be stimulated in the lab by decreasing the resting potential electronically. How is a LAP *likely* stimulated *in situ* when, for example, a squid motor nerve stimulates a muscle fiber?