1. For which cell would the net inward flux of Ca2+ be greatest?

- A cell with $[Ca^{2+}]_o$ = 1.8 mM, $[Ca^{2+}]_i$ = 100 nM, and V_m = +40 mV
- A cell with $[Ca^{2+}]_o$ = 1.8 mM, $[Ca^{2+}]_i$ = 2.0 mM, and V_m = -40 mV
- A cell with $[Ca^{2+}]_o$ = 1.8 mM, $[Ca^{2+}]_i$ = 10 µM, and V_m = -40 mV
- A cell with $[Ca^{2+}]_o$ = 1.8 mM, $[Ca^{2+}]_i$ = 100 nM, and V_m = -40 mV
- A cell with $[Ca^{2+}]_o$ = 1.8 mM, $[Ca^{2+}]_i$ = 10 µM, and V_m = +40 mV

2. If the ion concentrations given below describe the cytoplasm in a large axon just before an action potential, which of the following would be the most plausible set of ion concentrations immediately after an action potential when V_m has returned to the resting value?

Before action potential: $[Na^+]_e$ = 145 mM, $[K^+]_e$ = 5 mM, $[Na^+]_i$ = 15 mM, $[K^+]$i = 150 mM

After:

- $[Na^+]_e$ = 100 mM, $[K^+]_e$ = 50 mM, $[Na^+]_i$ = 60 mM, $[K^+]_i$ = 105 mM
- $[Na^+]_e$ = 155.2 mM, $[K^+]_e$ = 14.8 mM, $[Na^+]_i$ = 4.8 mM, $[K^+]_i$ = 140.2 mM
- $[Na^+]_e$ = 144.99 mM, $[K^+]_e$ = 5.01 mM, $[Na^+]_i$ = 15.01 mM, $[K^+]_i$ = 149.99 mM
- $[Na^+]_e$ = 75 mM, $[K^+]_e$ = 75 mM, $[Na^+]_i$ = 75 mM, $[K^+]_i$ = 75 mM

3. The current passing through a single channel is the product of the conductance of the channel and the driving force. The conductance expresses how easily or quickly ions can move through the channel (conductance is the inverse of resistance). The driving force for an ion is the difference between the ion's Nernst potential and the actual membrane potential at the time.

In other words: $i_x = g_x * (V_m - E_x)$, where:

i_x is the current through the channel
g_x is the conductance of the channel
V_m is membrane voltage, and
E_x is the Nernst potential for the ion

A typical voltage-gated Na^+ channel has a single-channel conductance of 20 picosiemens (p℧).

If V_m = - 50 mV and E_{Na+} = +50 mV, how many Na^+ ions can pass through one Na^+ channel in one millisecond?

Ions per millisecond 12500

Correct! That's a lot of ions in a hurry!