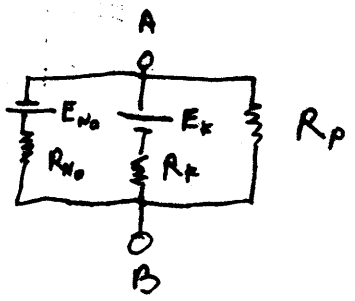
Example Problem



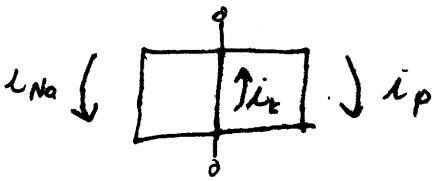
Given $E_{Na} = 50\ mV$ $R_{Na} = 200\ \Omega$

$E_k = 90\ mV$ $R_k = 10\ \Omega$

$R_p = 1000\ \Omega$

solve for the i's

Arbitrarily assume directions of i's & name them



There are 3 loops, though the third could be solved from the first 2

Thus, get 2 equations from 2 loops, K's 2nd law

$-E_{Na} + R_{Na} I_{Na} - R_p I_p = 0 \rightarrow 200\ I_{Na} - 1000\ I_p = 50$ (eq1)

$-E_{Na} + R_{Na} I_{Na} + I_k R_k - E_k = 0$

$21 \times 10^3 I_{Na} + 1000\ I_p = 14 \times 10^3$ (Eq4)

$200\ I_{Na} + 10\ I_k = 140$ (eq 2)

Since it takes 3 equations to solve for 3 unknowns, and since the 3rd loop would give a redundant equation,

Take K's 1st law

$I_{Na} + I_p = I_k$. To convert I_k in 1(a) to I_p, (eq. 3) $10\ I_{Na} + 10 I_p = 10 I_k$

$210\ I_{Na} + 10 I_p = 140 \rightarrow$ (x100)

(-1)

$21200\ I_{Na} = 14050$ (Eq1 + Eq4)

$I_{Na} = .663\ mamp$ substitute for others

$I_k = .74\ nA$

$I_p = .0626$