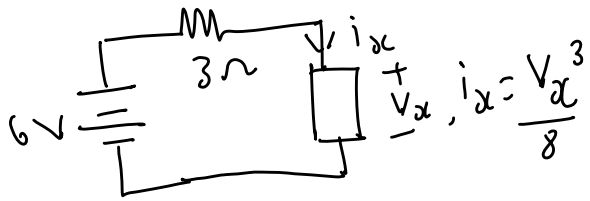
EE40 Fall 05 - HW #8 Solutions - BART

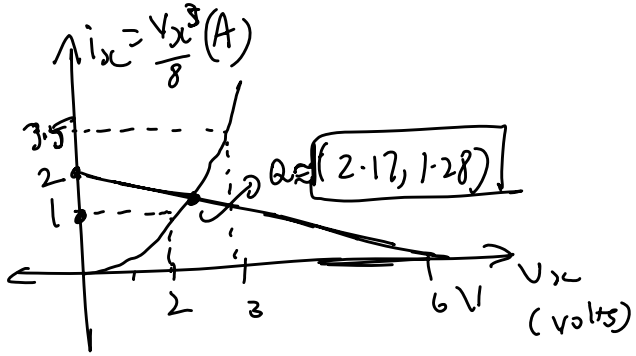
Note Title 11/1/2005

(10.8) $i_D = I_S e^{v_D/nV_T} \Rightarrow \frac{i_{D1}}{i_{D2}} = \frac{e^{v_{D1}/nV_T}}{e^{v_{D2}/nV_T}} = e^{((v_{D1}-v_{D2})/nV_T)} \Rightarrow \boxed{n = 1.336}$

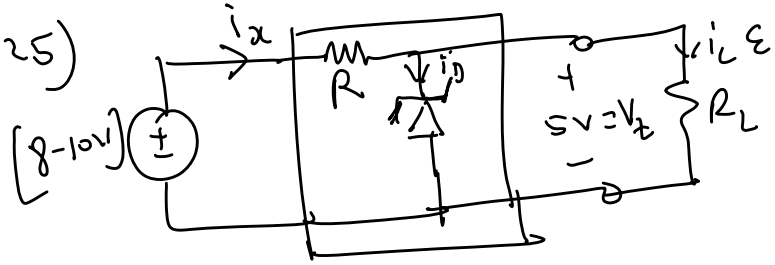
$\therefore \boxed{I_S = 31.5\ pA}$

(10.16)





(10.25)



$i_L \in [0\ mA, 100\ mA]$ KCL: $i_x = i_D + i_L$

Now, choose $V_Z = 5V$, we want R such that $i_D > 0$ for all i_L

Now, as V_{in} increases, i_x will increase $\Rightarrow$ WORST CASE: $V_{in} = 8V$, $i_L = 100\ mA$

$\therefore\ i_x = \frac{V_{in} - V_Z}{R} \Rightarrow R = \frac{3}{i_x}$.

Suppose $R = 1k$, $i_x = 3\ mA \Rightarrow i_D = -97\ mA$ ✗

$\therefore$ $R = 1\Omega$, $i_x = 3A \Rightarrow$ way too big, although will work.

Ideally: $i_D = 0 \Rightarrow i_x = 100\ mA \Rightarrow \boxed{R = 30\Omega}$

$\therefore$ $R = 30\,\Omega$ (ideal), $V_z = 5\,V$

Worst case power: $V_{in} = 10\,V$

$\therefore P_{zener} = V_{zener} i_{zener}$

$= (-5)(-66\,mA)$

$P_{zener} = .320\,W$

$P_{30\Omega} = i^2 R = 0.83\,mW$

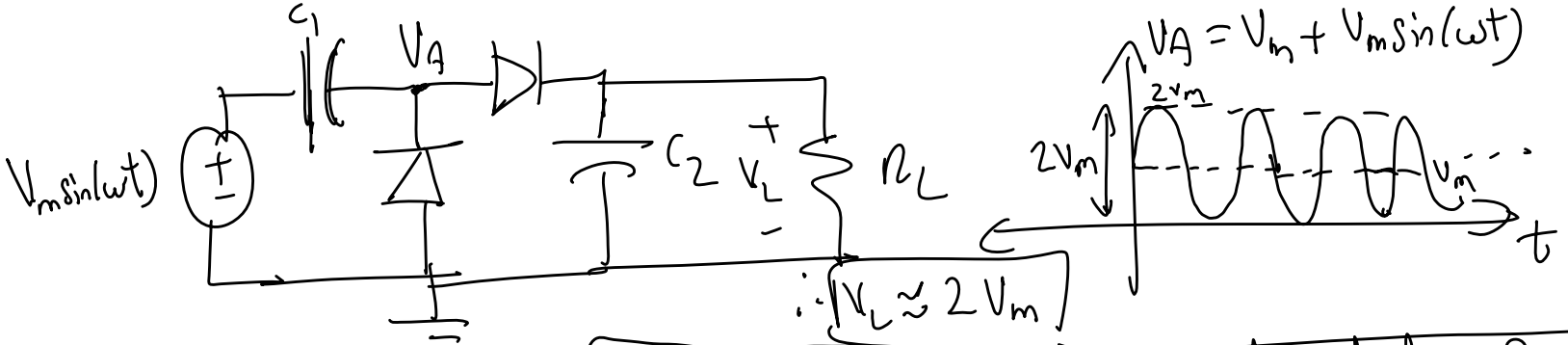
(10.33) Have to make an educated guess about diode states:

(a) D_1 on, D_2 off. $V = 10\,V$, $I = 0\,A$

(b) D_1 on, D_2 off, $V = 6\,V$, $I = 6\,mA$

(c) D_1 on, D_2 on. $V = 30\,V$, $I = 33.6\,mA$

(10.61) This circuit is explained in lecture 25:



$\therefore V_L \approx 2V_m$

$\therefore$ Peak inverse voltage on each diode $= 2V_m$