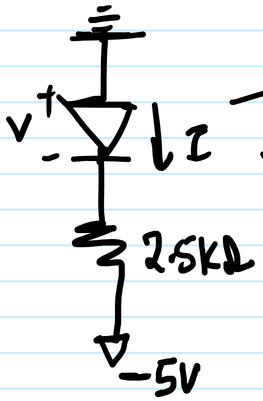
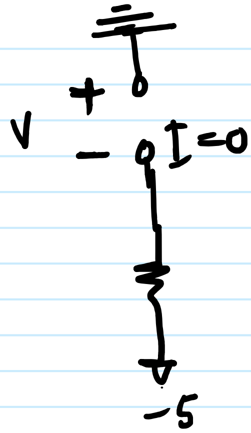
Diodes (Ideal)

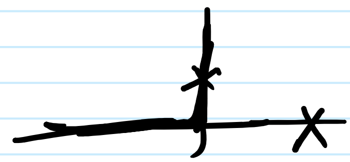
Monday, March 18, 2024 3:40 PM



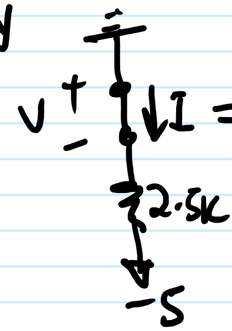
off



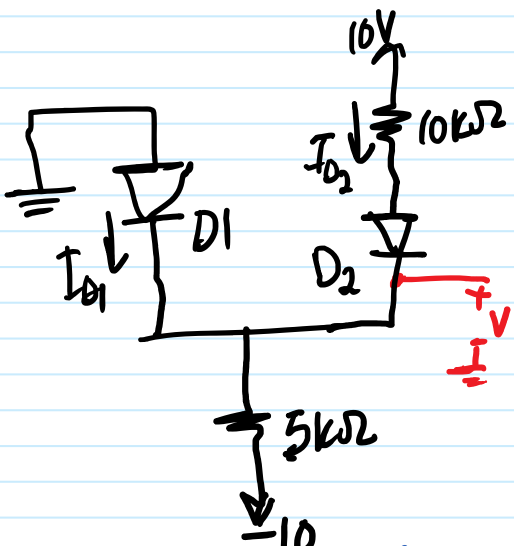
$V = 0-(-5) = 5V$



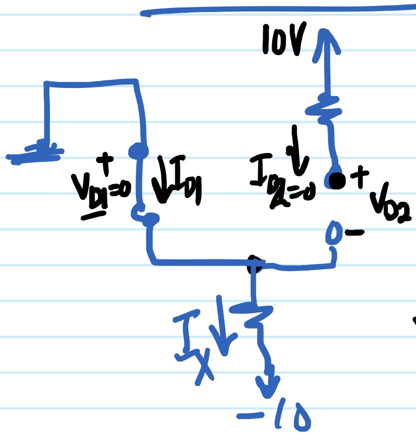
Not OK.



$I = \frac{0-(-5)}{2.5k} = 2mA$ ✓ OK



Assume D1 ON, D2 OFF



$I_{D1} = I_x = \frac{0-(-10)}{5k}$

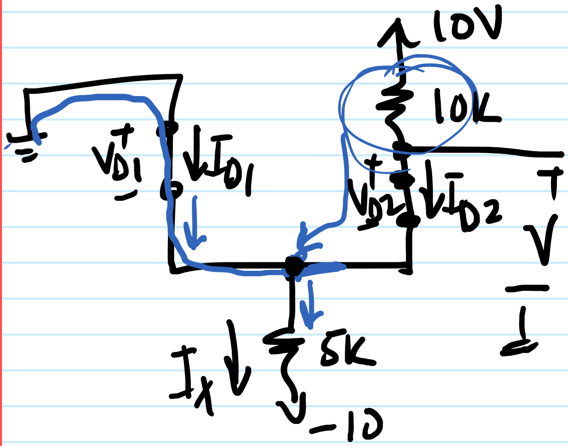
$= 2mA$

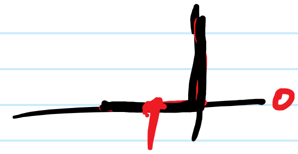
D1 ON → OK

$V_{D2} = 10-0 = 10V$ ✗

D2 OFF NOT OK

Assume both D1, D2 ON





$V_{D1} = V_{D2} = 0V$

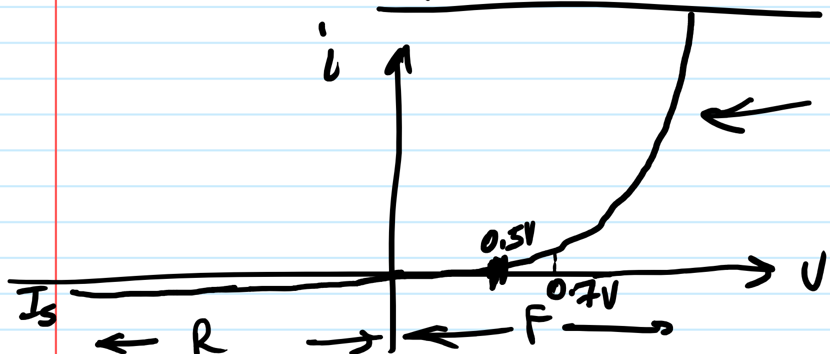
$I_x = \frac{0-(-10)}{5K} = 2mA$

$I_{D2} = \frac{10-0}{10K} = 1mA$ ✓ OK

$I_{D1} = 1mA$ ✓ OK

$V = 0.$

Real Diode



$i = I_s(e^{v/nV_T} - 1)$

$I_s \to$ saturation current

$n \to$ constant (1−2)

Use n = 1

$V_T = \frac{kT}{q}$ $k \to$ Boltzmann constant

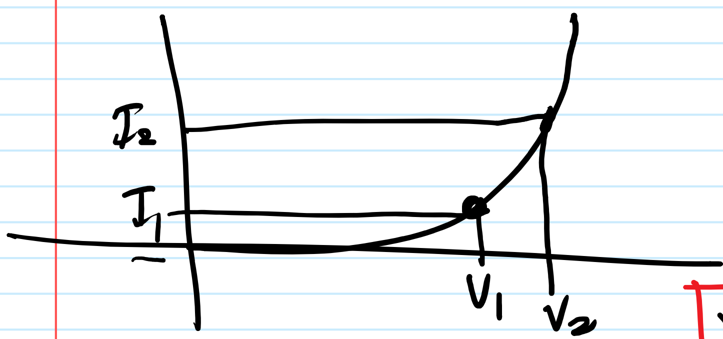
$q = e^-$

$T \to$ absolute temperature (K)

$V_T \simeq 25mV$ (@ room temperature)

At reverse bias, $i = -I_s$

Forward Region



$$I_1 = I_S\left(e^{V_1/nV_T} - 1\right)$$

$$I_2 = I_S\left(e^{V_2/nV_T} - 1\right)$$

$$V_2 - V_1 = nV_T \ln\left(\frac{I_2}{I_S}\right) - nV_T \ln\left(\frac{I_1}{I_S}\right)$$

$$\boxed{V_2 - V_1 = nV_T \ln\left(I_2/I_1\right)}$$