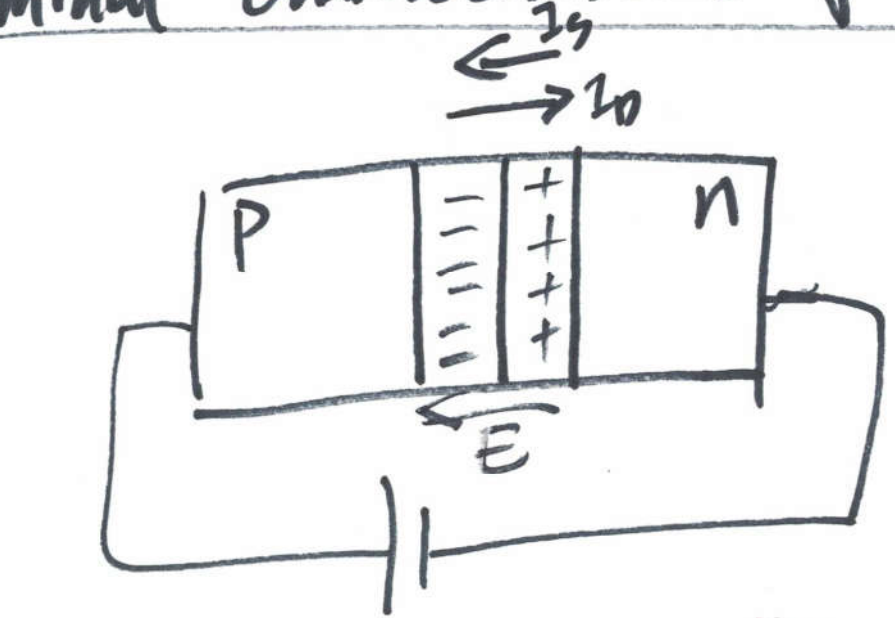
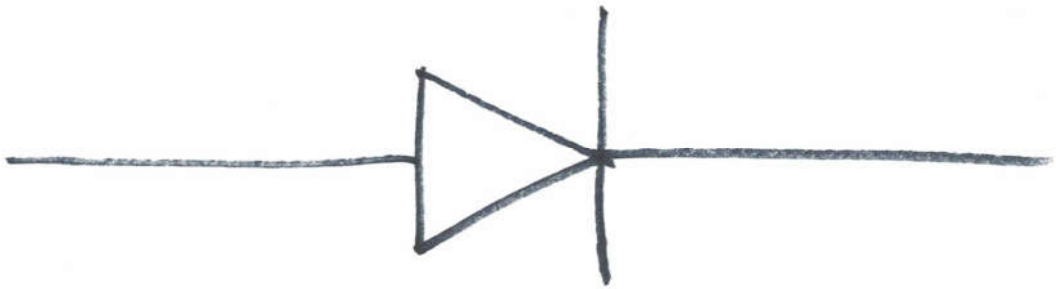
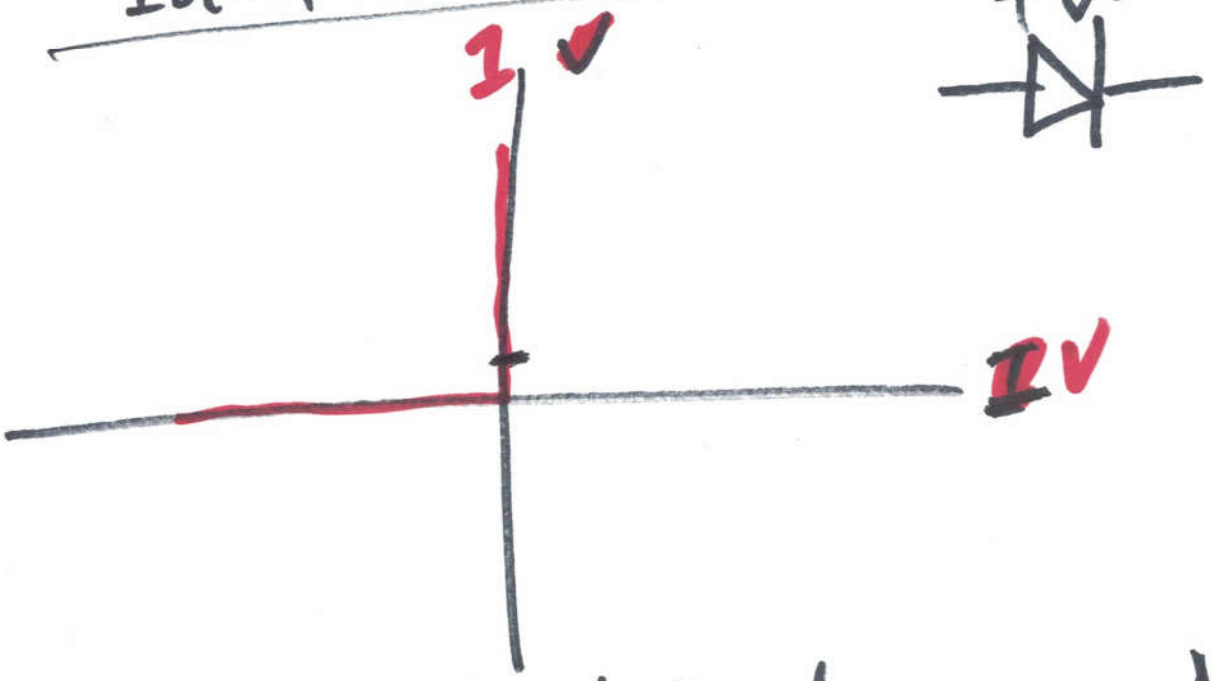
Terminal Characteristics of Diodes

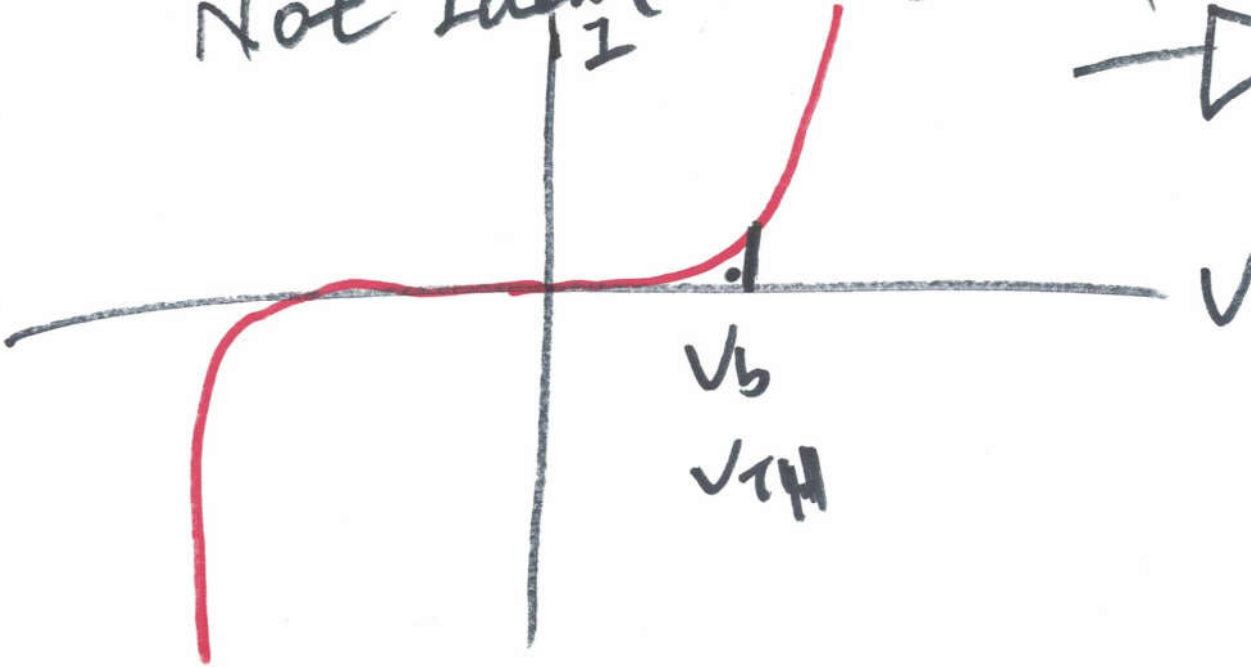


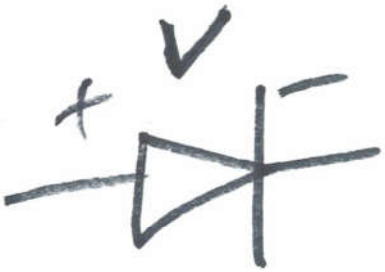


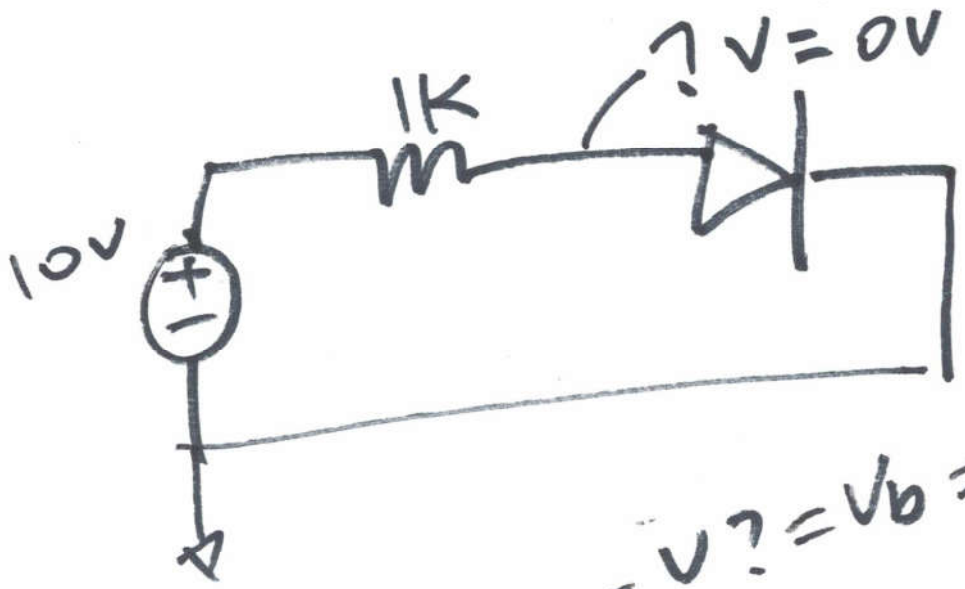
Ideal Diode I/V Curve



Not Ideal Diodes

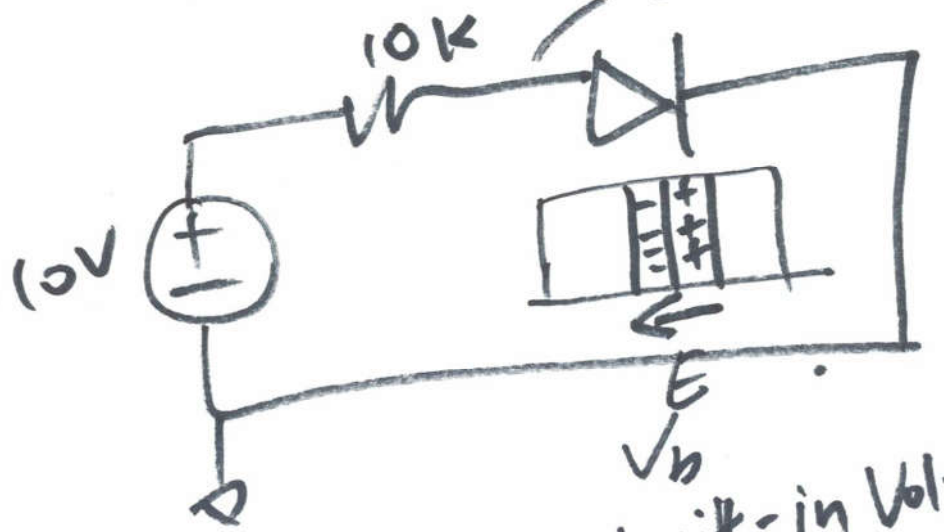




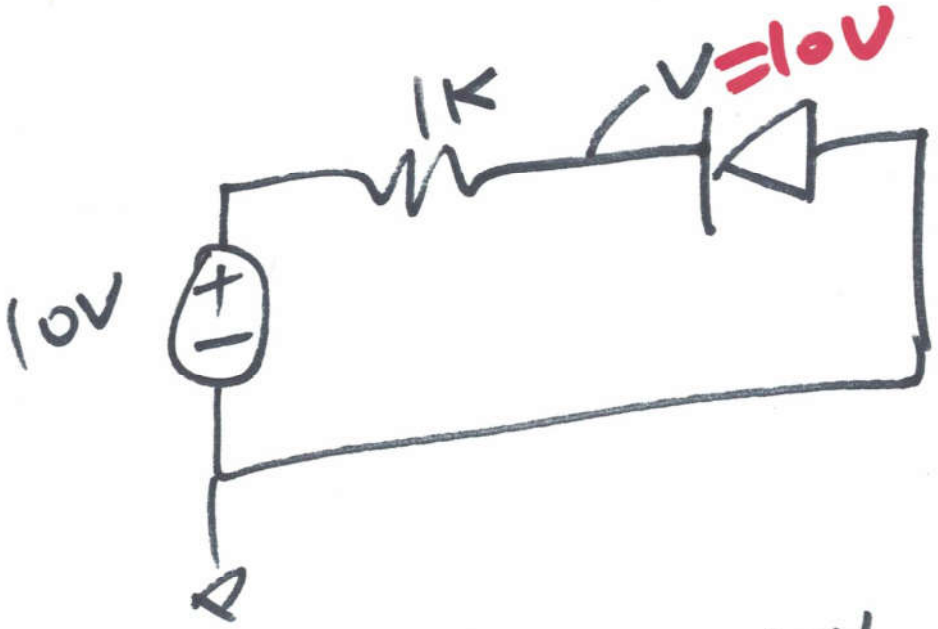


Ideal Diode

$V_? = V_b = 0.6 / 0.7V$

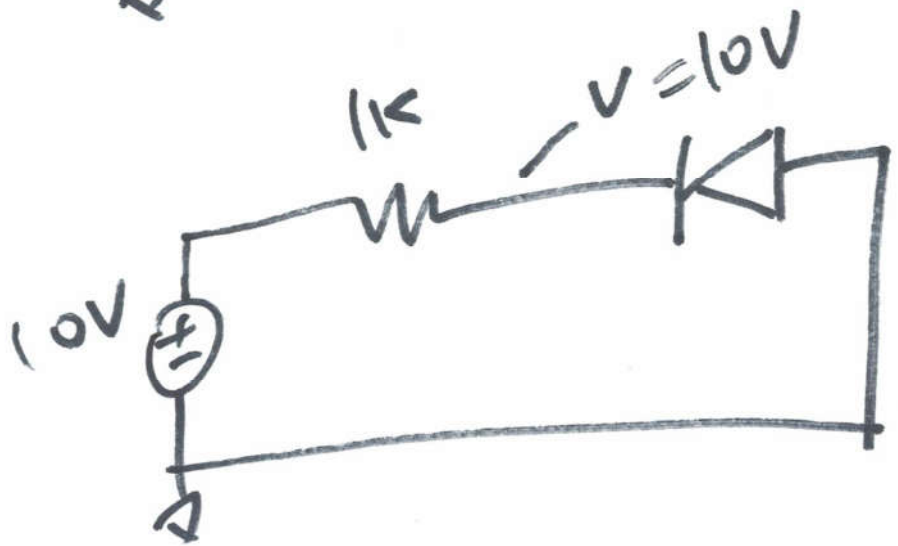


Non-ideal Diode



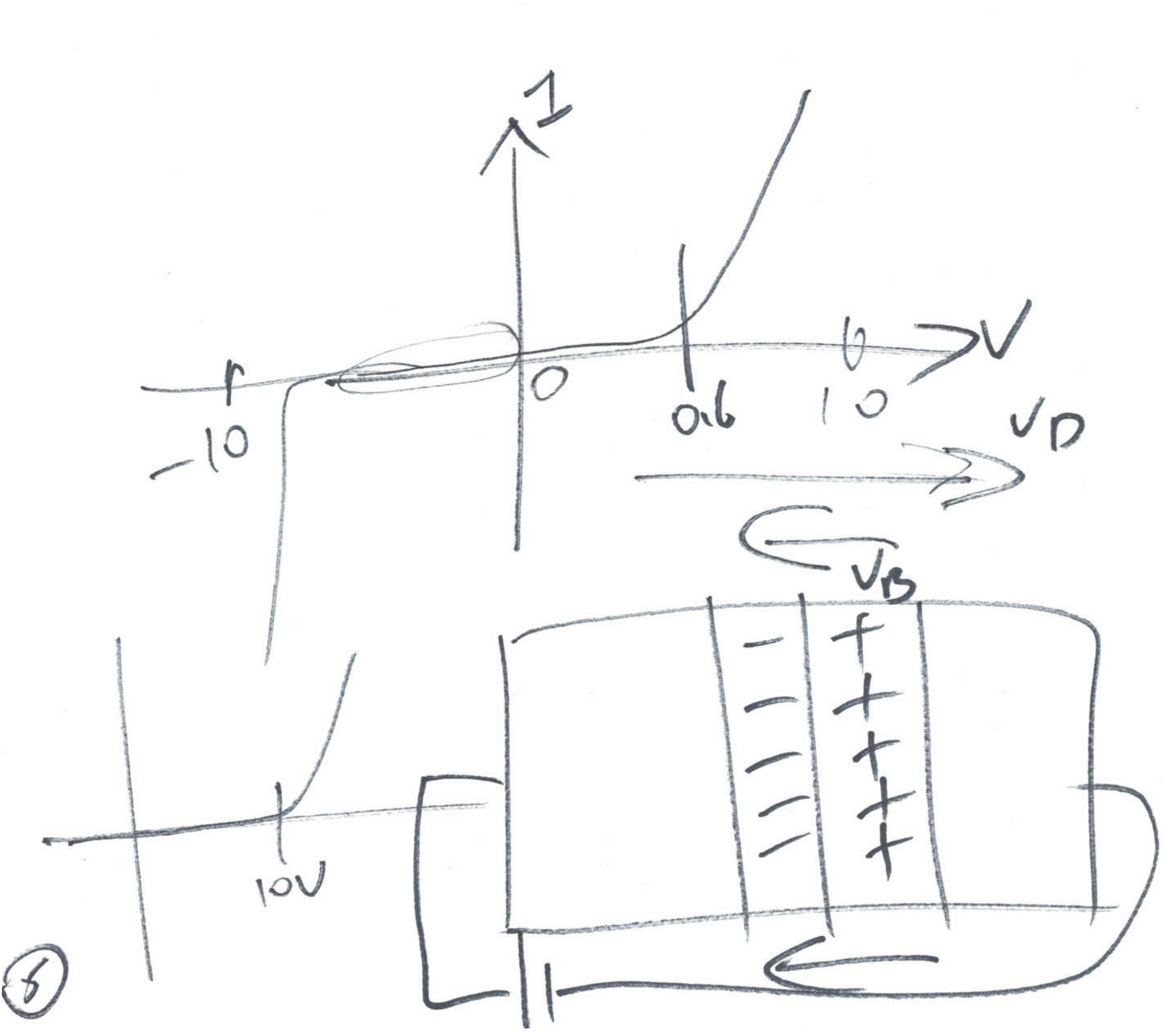
Ideal Diode

No reverse Breakdown



Non-ideal Diode

No reverse-breakdown.


I
V
-10
0
0.6
1.0
V_D
V_B
10V

$$I_D = I_S\left(e^{V_D/V_T} - 1\right)$$

V_D : Forward Bias voltage

V_T : Constant, thermal voltage

$20^\circ C$, $V_T = 25mV$

Forward Bias:

$$I_D \approx I_S \cdot e^{V_D/V_T}$$

Reverse Bias:

$$I_D \approx I_S \approx 0$$

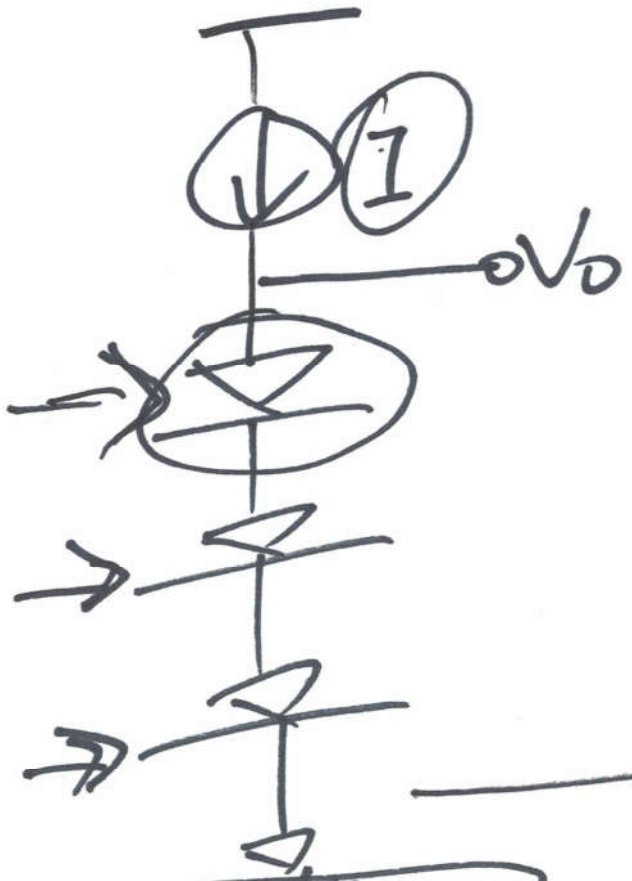
(b)

$$\begin{cases} I_D = 10^{-3} = I_S \cdot e^{0.7V/V_T} \\ I_{DX} = I_S \cdot e^{0.5V/V_T} \end{cases}$$

$$\frac{10^{-3}}{I_{DX}} = \frac{I_S \cdot e^{0.7V/V_T}}{I_S \cdot e^{0.5V/V_T}}$$

$$= e^{\frac{0.7-0.5}{V_T}} = e^{\frac{0.2}{V_T}}$$

$$I_{DX} = \frac{10^{-3}}{e^{\frac{0.2}{25mV}}} =$$



① I? to make $V_D = 2V$

$I_S = 10^{-14} A$

$V_D = \frac{2}{3} V$

$I_D = I_S \cdot e^{V_D/V_T}$

$= 10^{-14} \cdot e^{\frac{2}{3}/25mV} = 3.6mA$

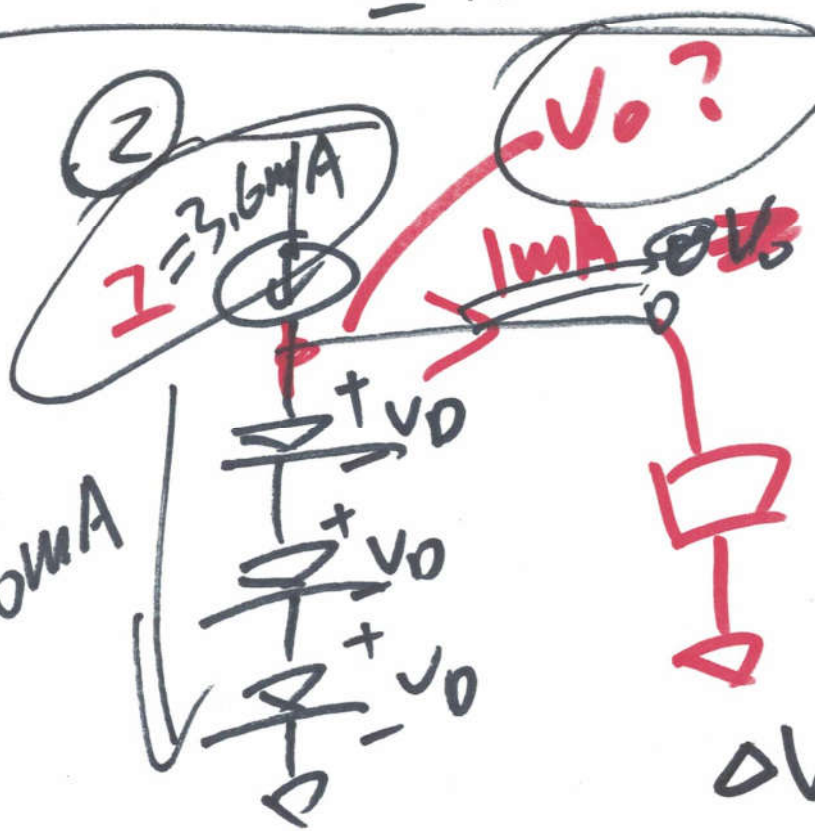
$I_D = I_S \cdot e^{V_D/V_T}$

$\frac{I_D}{I_S} = e^{V_D/V_T}$

$\ln \frac{I_D}{I_S} = \frac{V_D}{V_T}$

$V_D = V_T \ln \frac{I_D}{I_S}$

② $I_D = 2.6mA$



$V_D = 25mV \cdot \ln \frac{2.6mA}{10^{-14} A}$

$= 0.71V.$

$V_D = 3 \cdot V_D$

$= 2.13V.$

$\Delta V_D = 2 - 2.13V = -0.13V$