

Lecture 7 Part 2

Construction

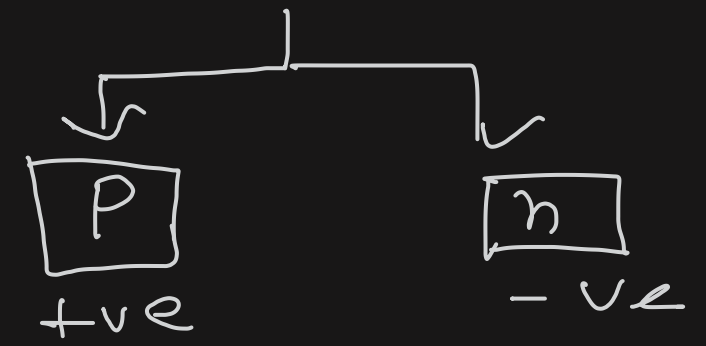
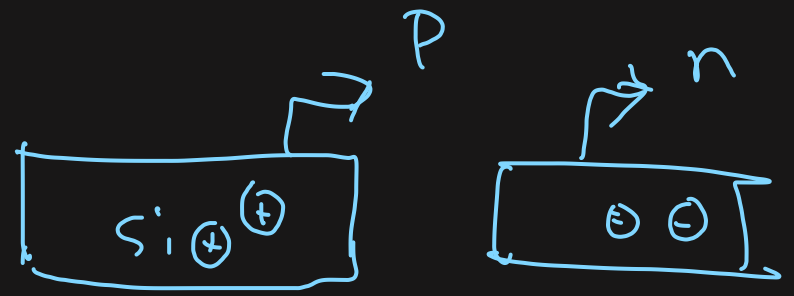
Conductivity
can be
controlled

→ p type
→ n type

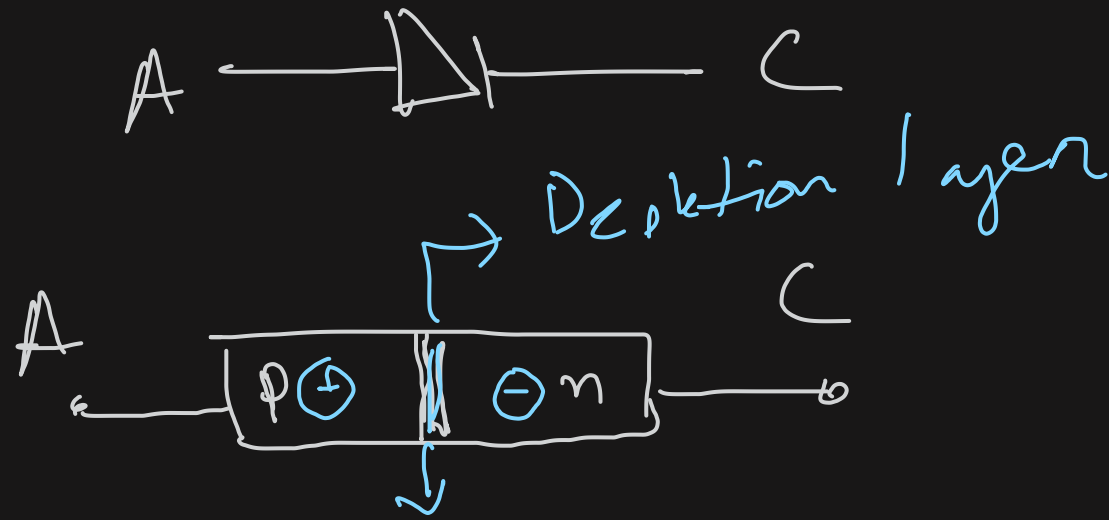
Semiconductor

Intrinsic
(Pure)

Extrinsic
(Impure)



p-n Junction Diode



Forward

Bias :
→ I_P

$A \rightarrow \Delta \rightarrow C$

Anode

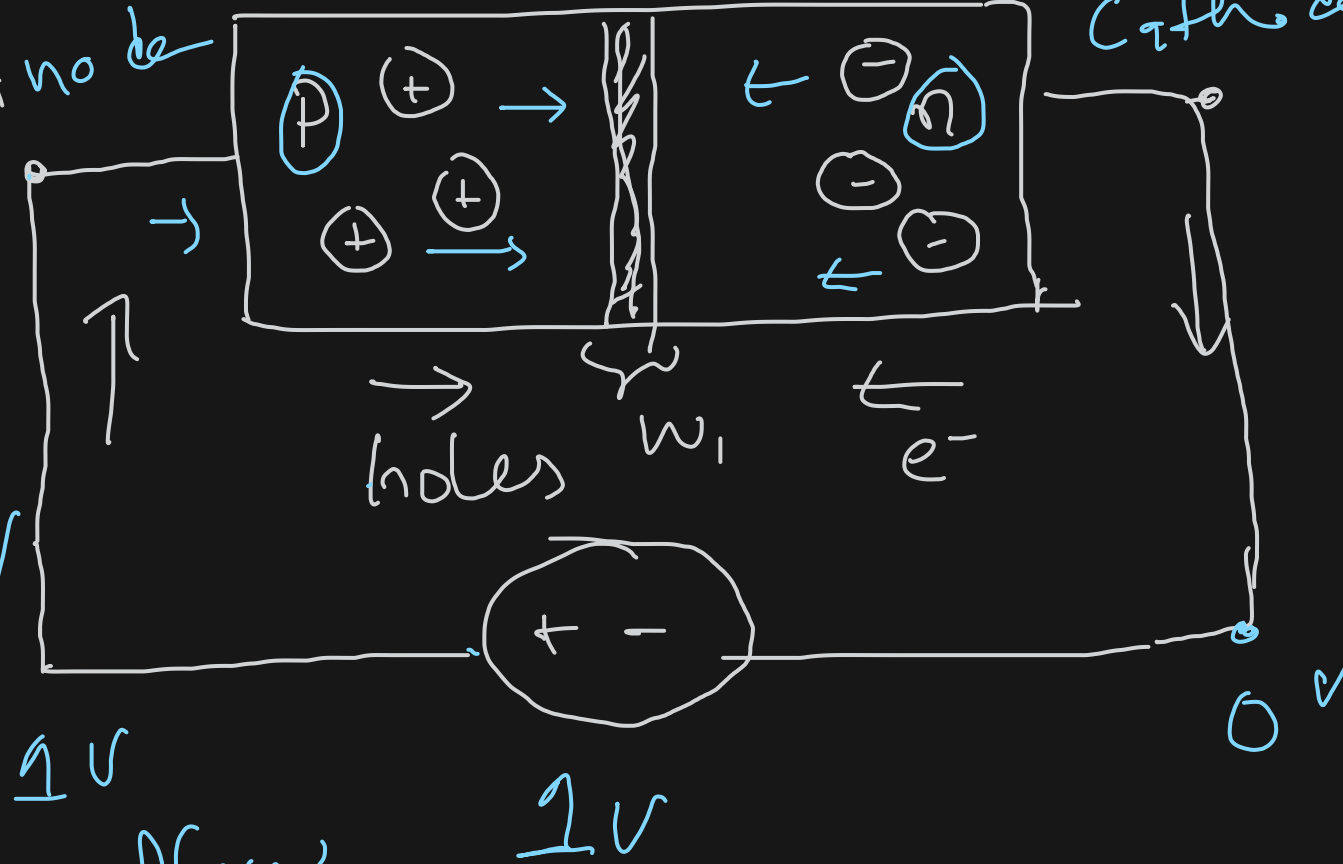
Cathode $V_A > V_C$

→ Forward

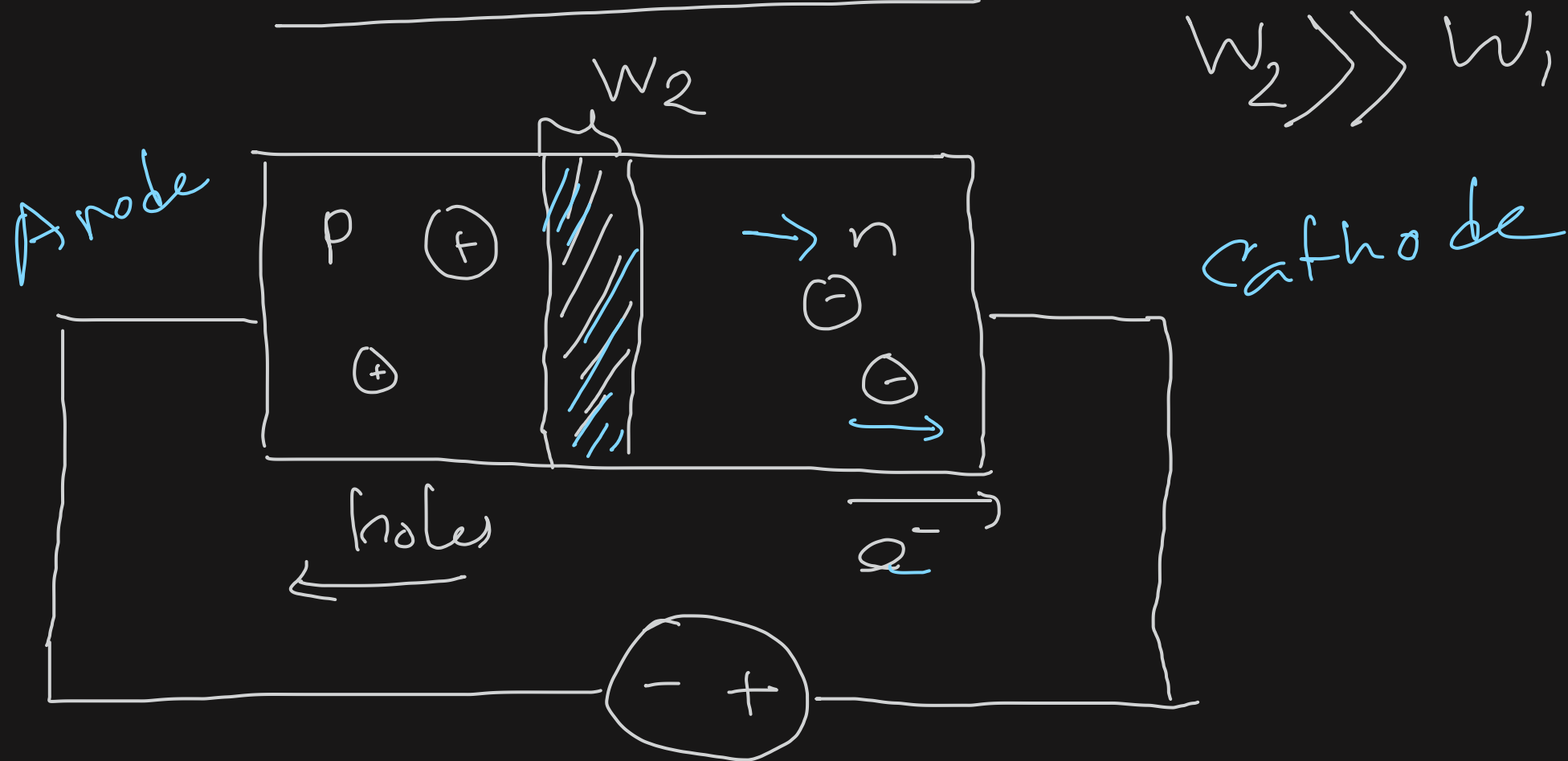
$I \uparrow \downarrow e^-$

$I_P \rightarrow$ hole flow current

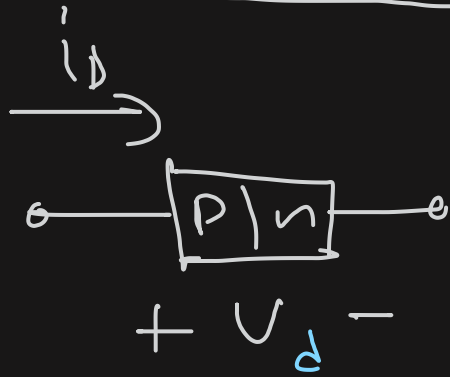
$I_n \rightarrow e^-$ flow



Reverse Bias

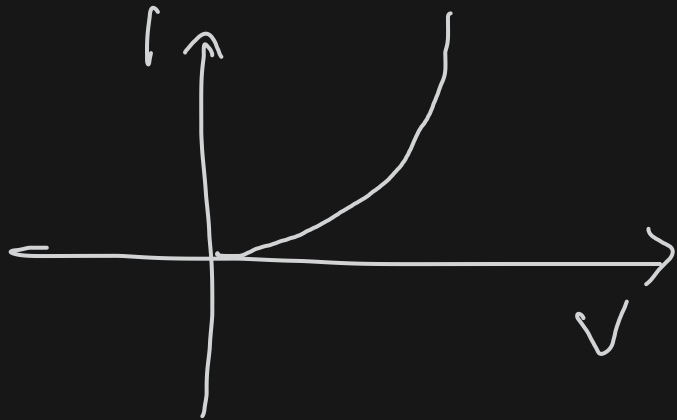


✓✓ Diode Equation ✓



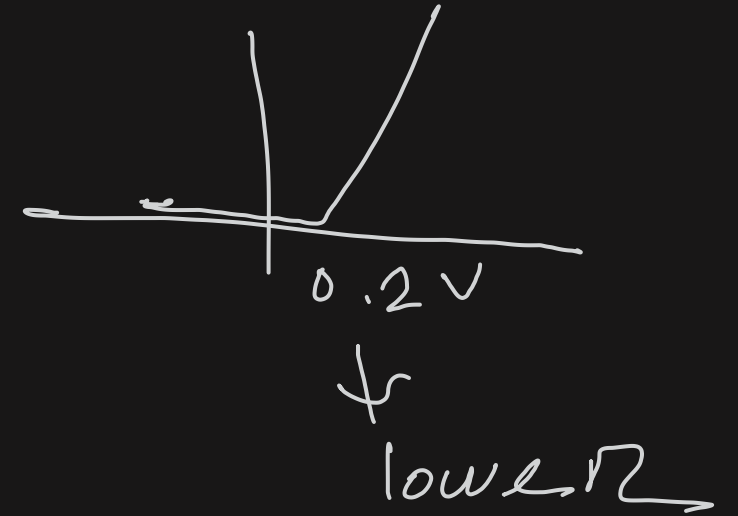
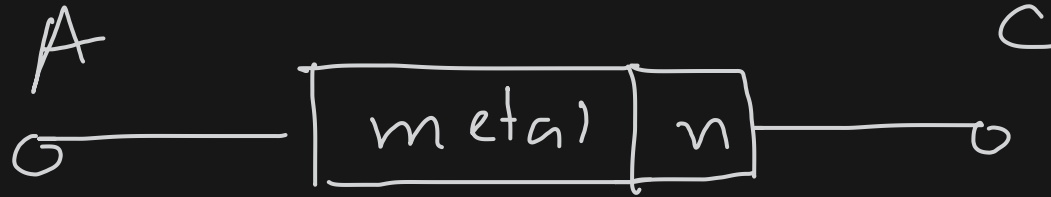
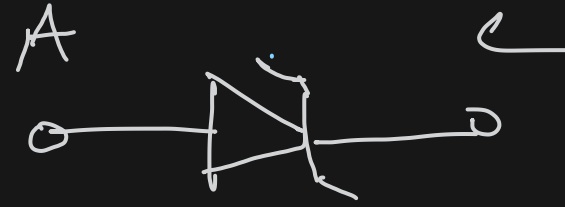
$$i_D = I_s \left(e^{\frac{V_D}{V_T}} - 1 \right)$$

✓ I_s = Reverse saturation current = $10^{-9} \sim 10^{-12} \text{ A}$



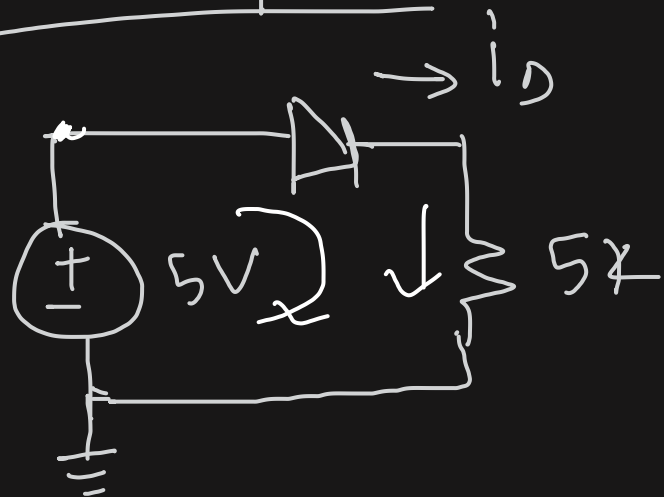
✓ $V_T = 25 \text{ mV} = 0.025 \text{ V}$
= Thermal voltage

Schottky diode



→ Cut-in lower : V_D

Examples

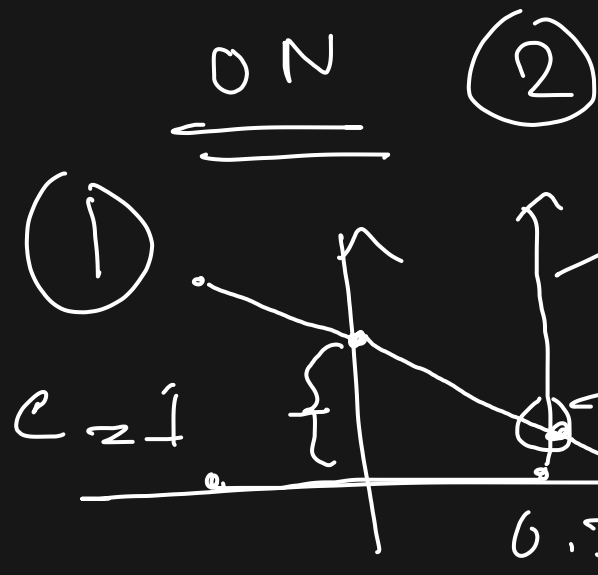


KVL

$$V_D + 5i_D - 5 = 0$$

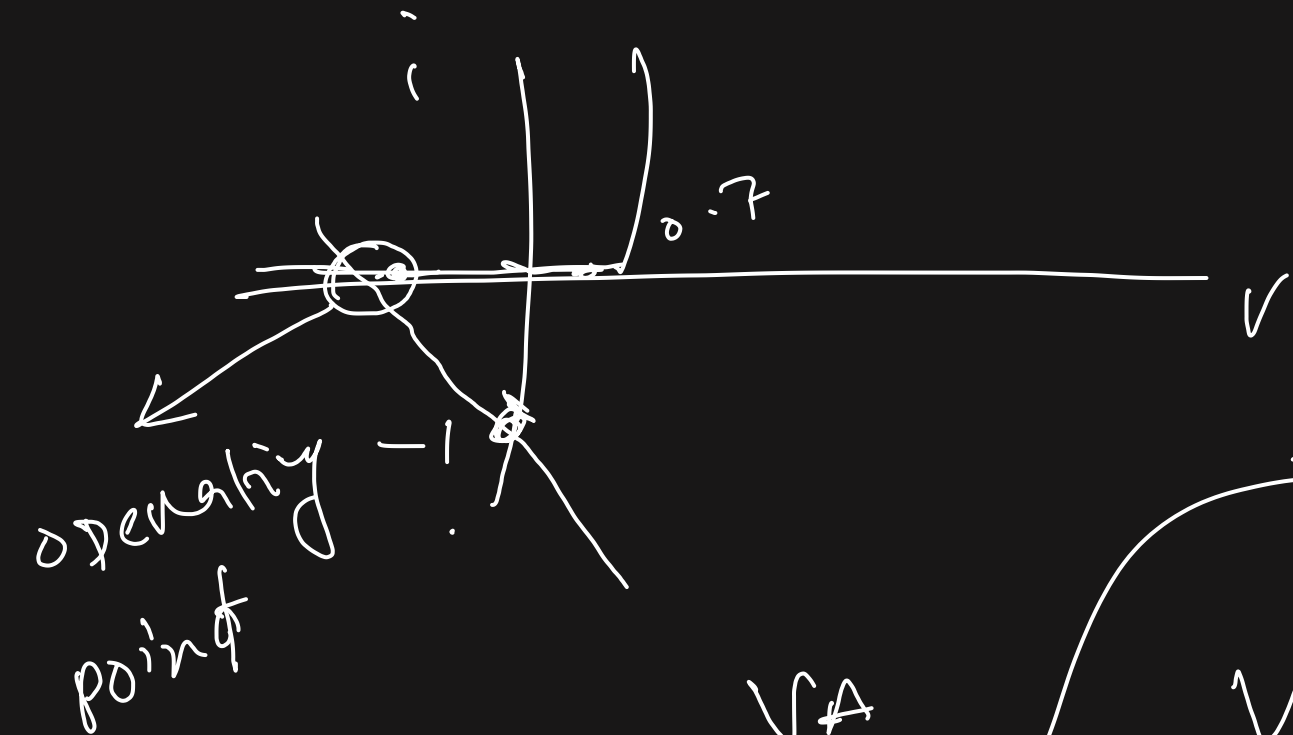
$$\Rightarrow 5i_D - 5 = -V_D$$

$$\Rightarrow i_D = \frac{1}{5}V_D + 1$$

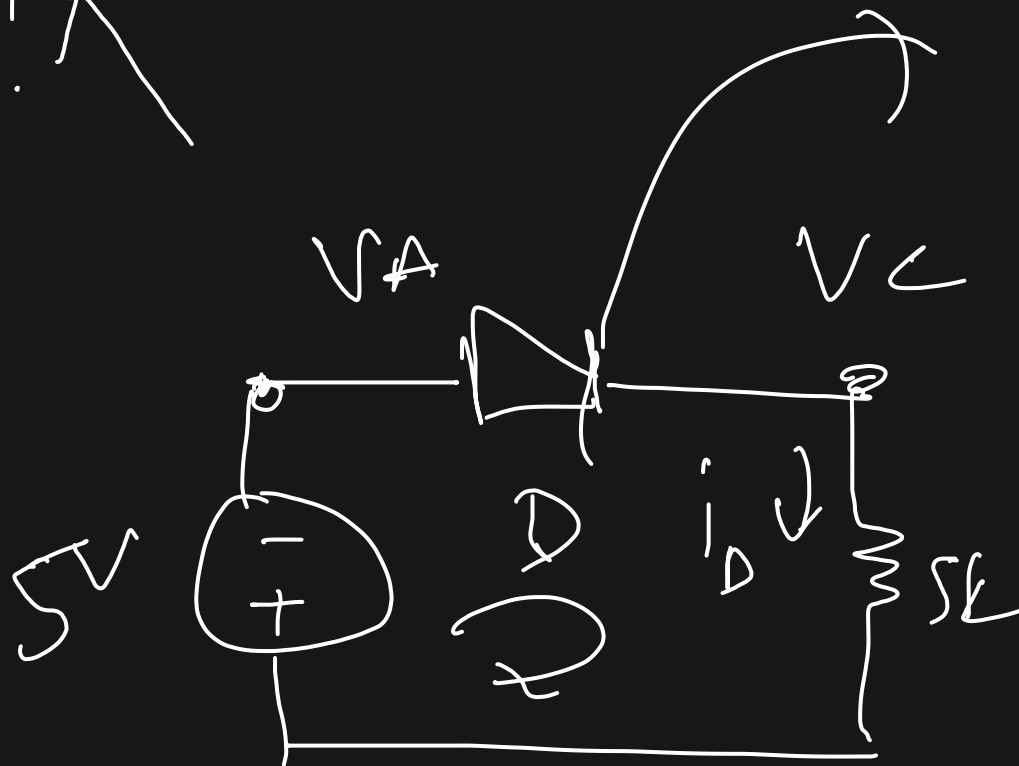
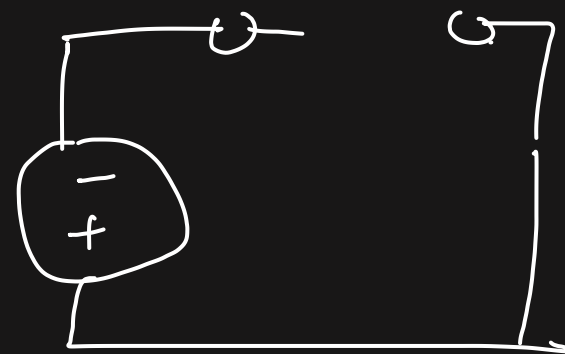


$$y = mx + c$$

$$y = -mx + c$$



OFF



$$V_D + 5i_D + 5 = 0$$

$$\Rightarrow i_D = -\frac{1}{5}V_D - 1$$

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

$$I_S = 10^{-12} \text{ A}, \quad V_T = 0.025 \text{ V}$$

$$V_D = \begin{cases} 0 \text{ V} \\ 0.7 \text{ V} \\ 5 \text{ V} \\ -2 \text{ V} \end{cases}$$