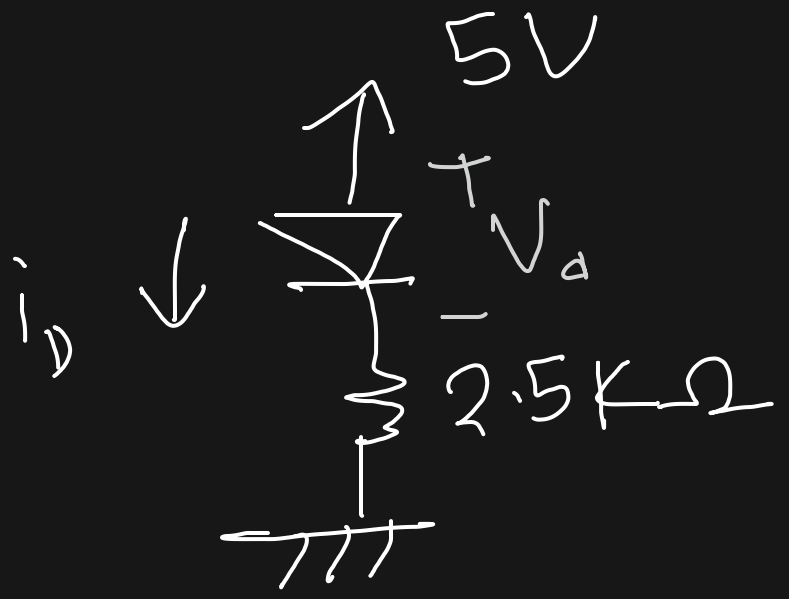
Lecture7

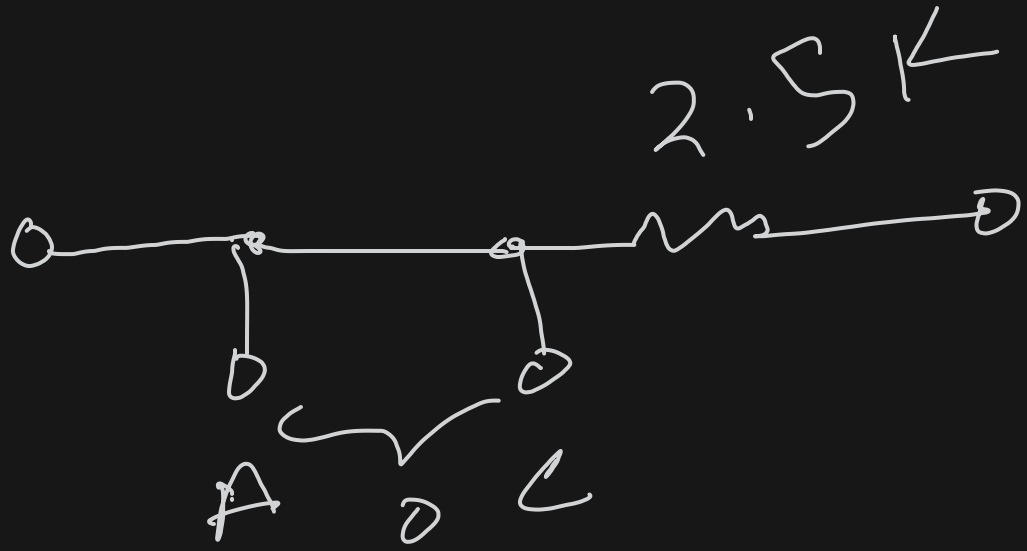
Diode : Non-idealities



#Power = V_i
= V_{did}
= 0

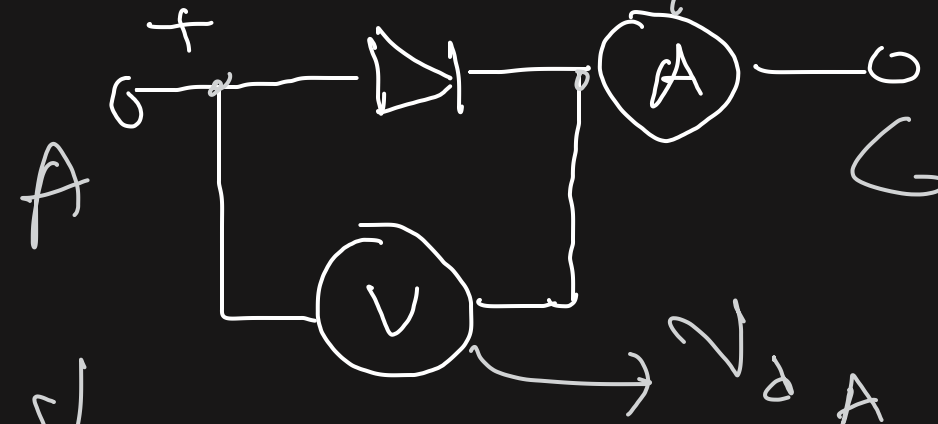
#Resistance = 0

} ideal



Non-ideality

1) Power



I_d

V_d

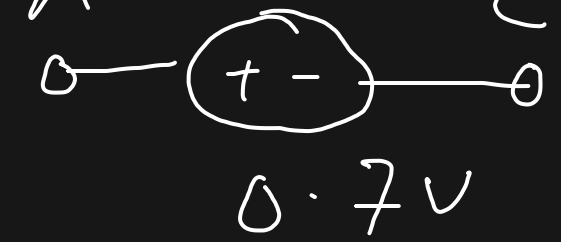
Diode:

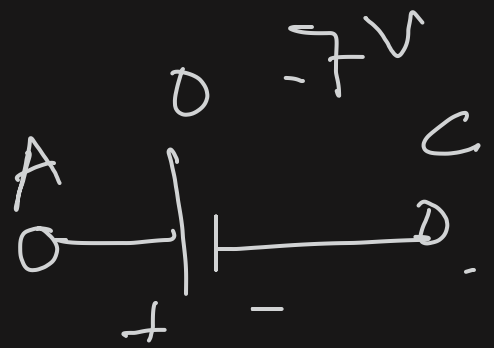
Power $= V_d I_d$

ON: $P \propto I$

$\Rightarrow$ Like voltage source

$\Rightarrow$ Si : 0.7V





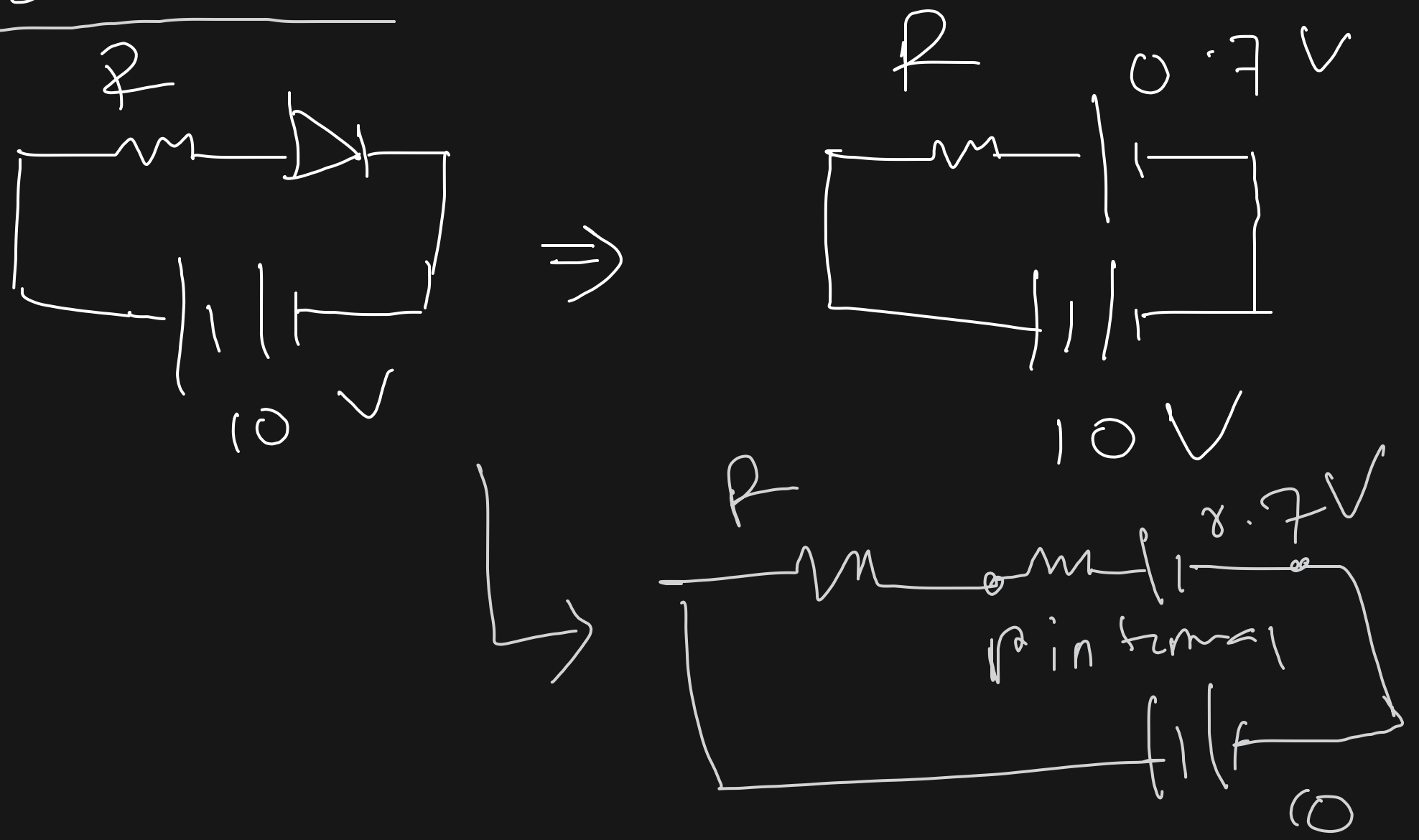
Ge : 0.3V

OFF:

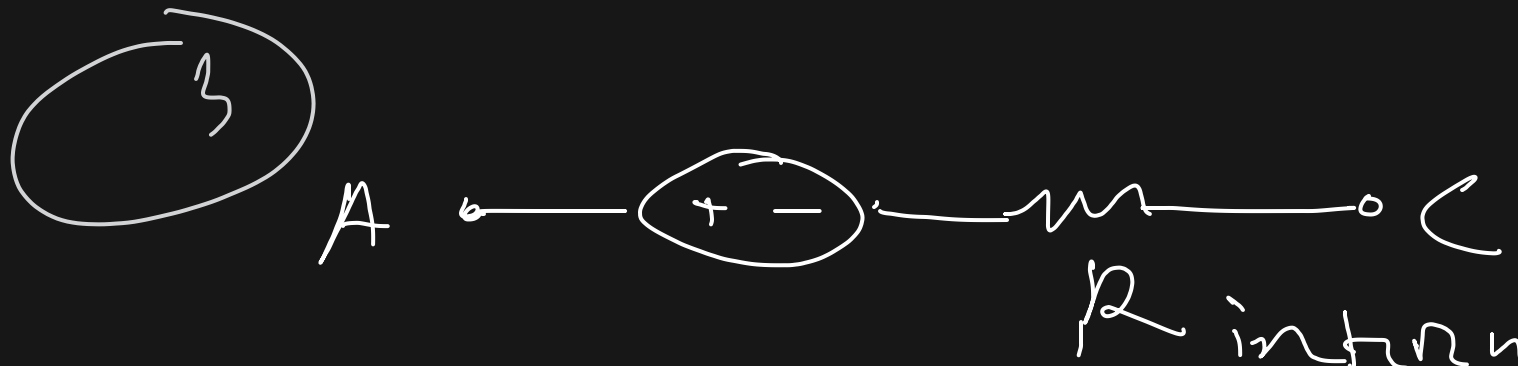
Still open circuit!

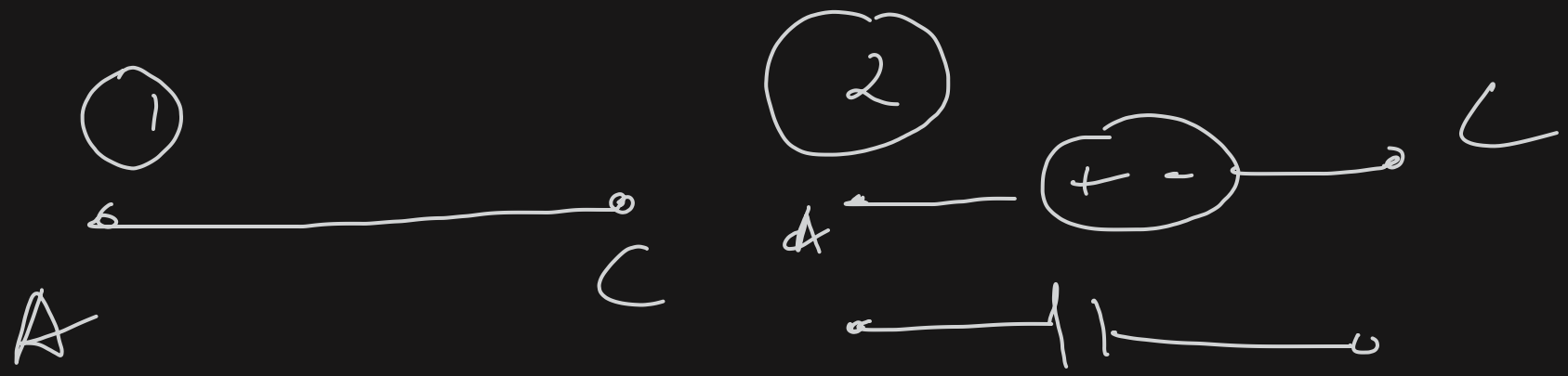
$$V_A - V_C = 0.7V$$

Resistance



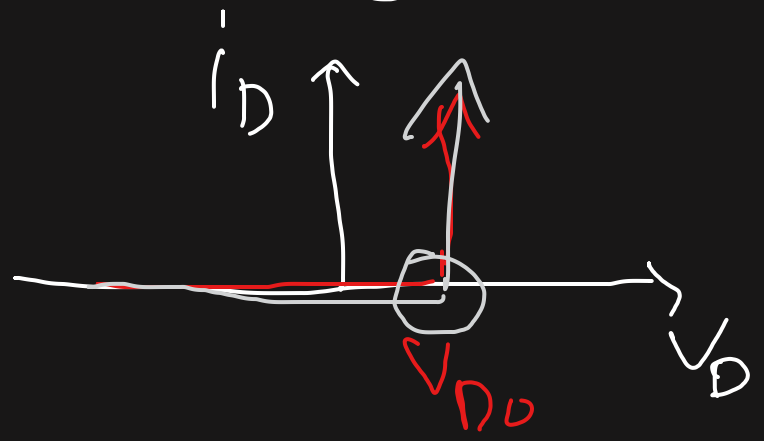
Material :→ Every material has some resistance!



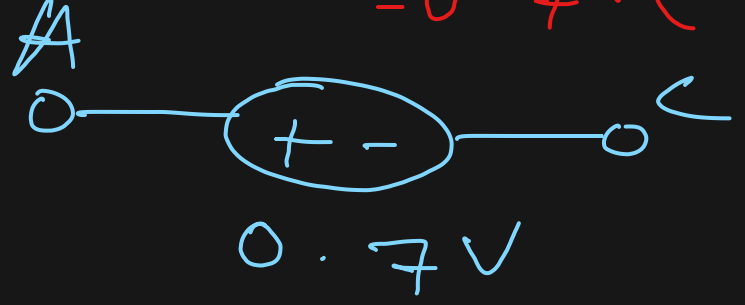


Piecewise Linear model (Non-ideal)

(2) Constant Voltage drop model (CVD)



$= 0.7V$ (Si)



ON:

Condition:

$i_D > 0$

State eqn:

$V_D = V_{D0}$

OFF

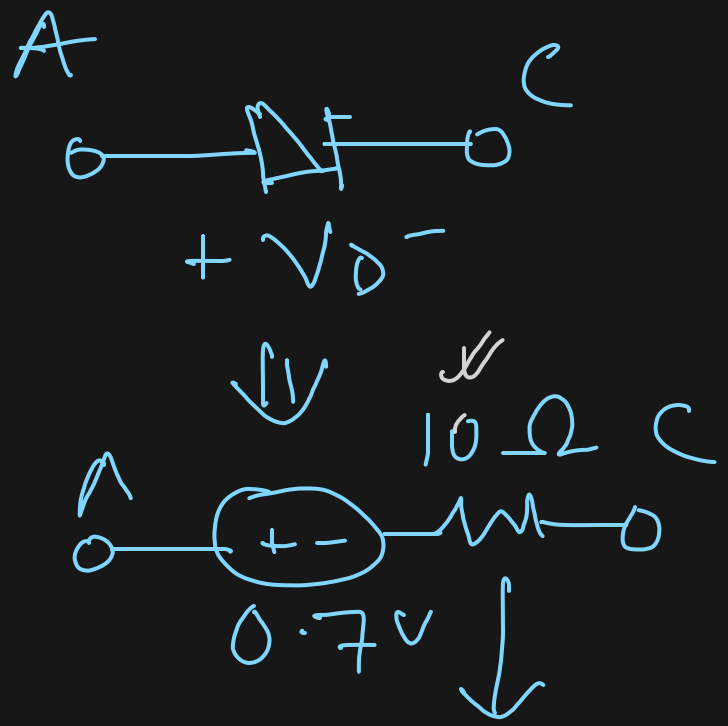
Condition:

$V_D < V_{D0}$

State eqn:

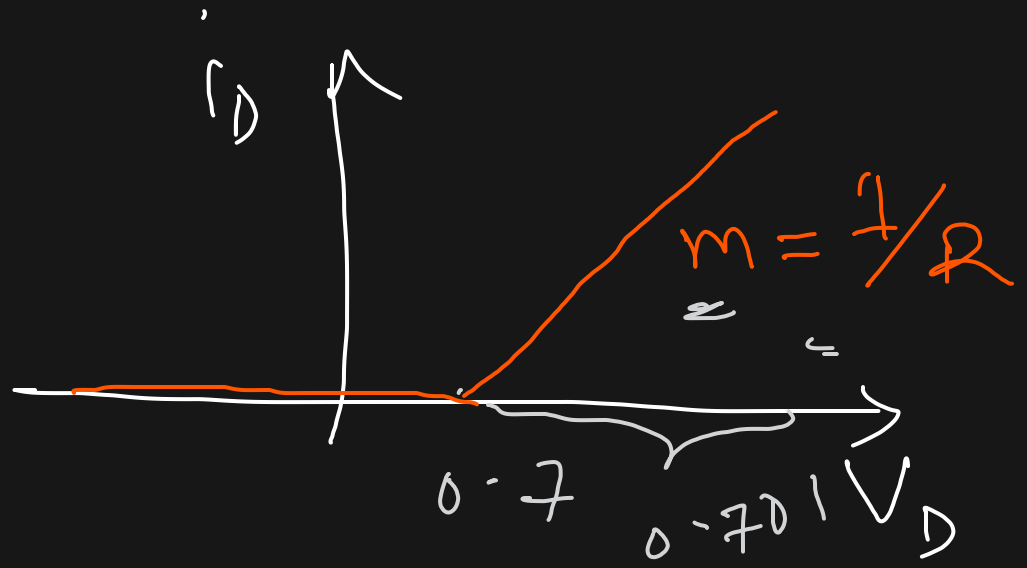
$i_D = 0$

③ Voltage source + Resistance Model



internal resistance

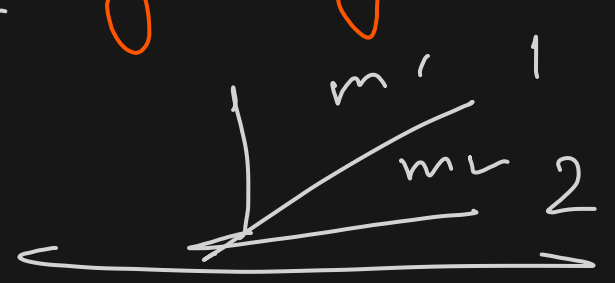
More Accurate



R → very low

→ m very high

1) $m_1 > m_2$
2) $m_1 < m_2$



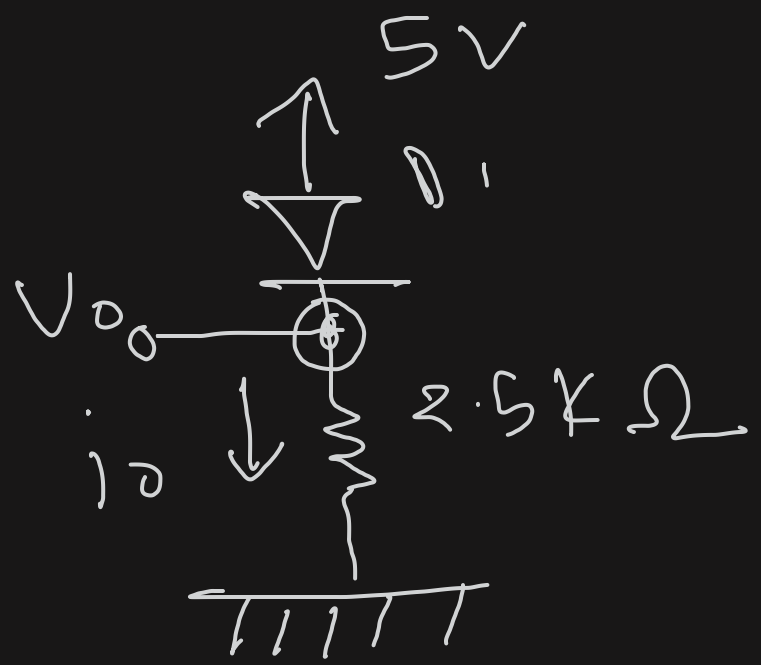
Which ONE To use?

1) Most accurate : Voltage source + Rs

2) Fastest : Ideal

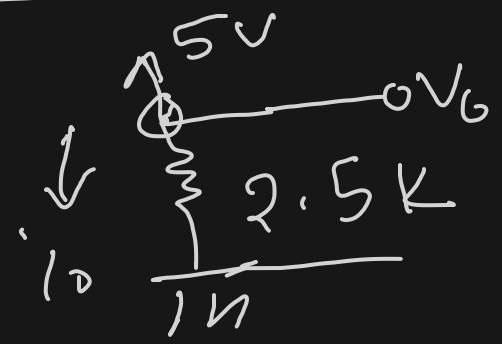
Example

Find V_o and i_o



(i) Ideal Model

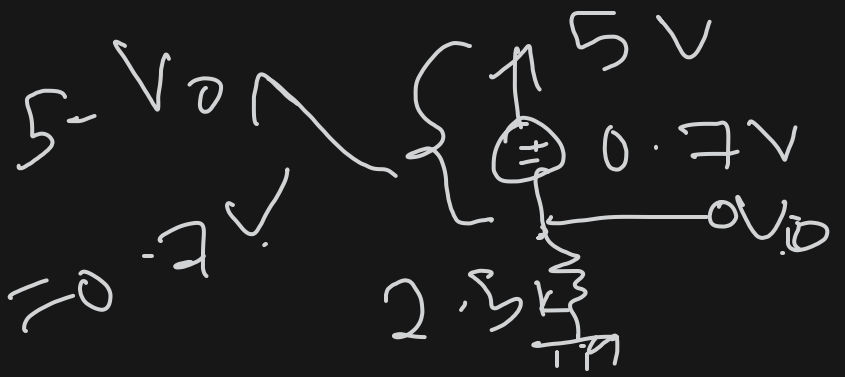
ON



$$i_o = \frac{5}{2.5} = 2\text{mA}$$

$\therefore V_o = 5V$

(ii) CVD Model ($V_D \approx 0.7V$)

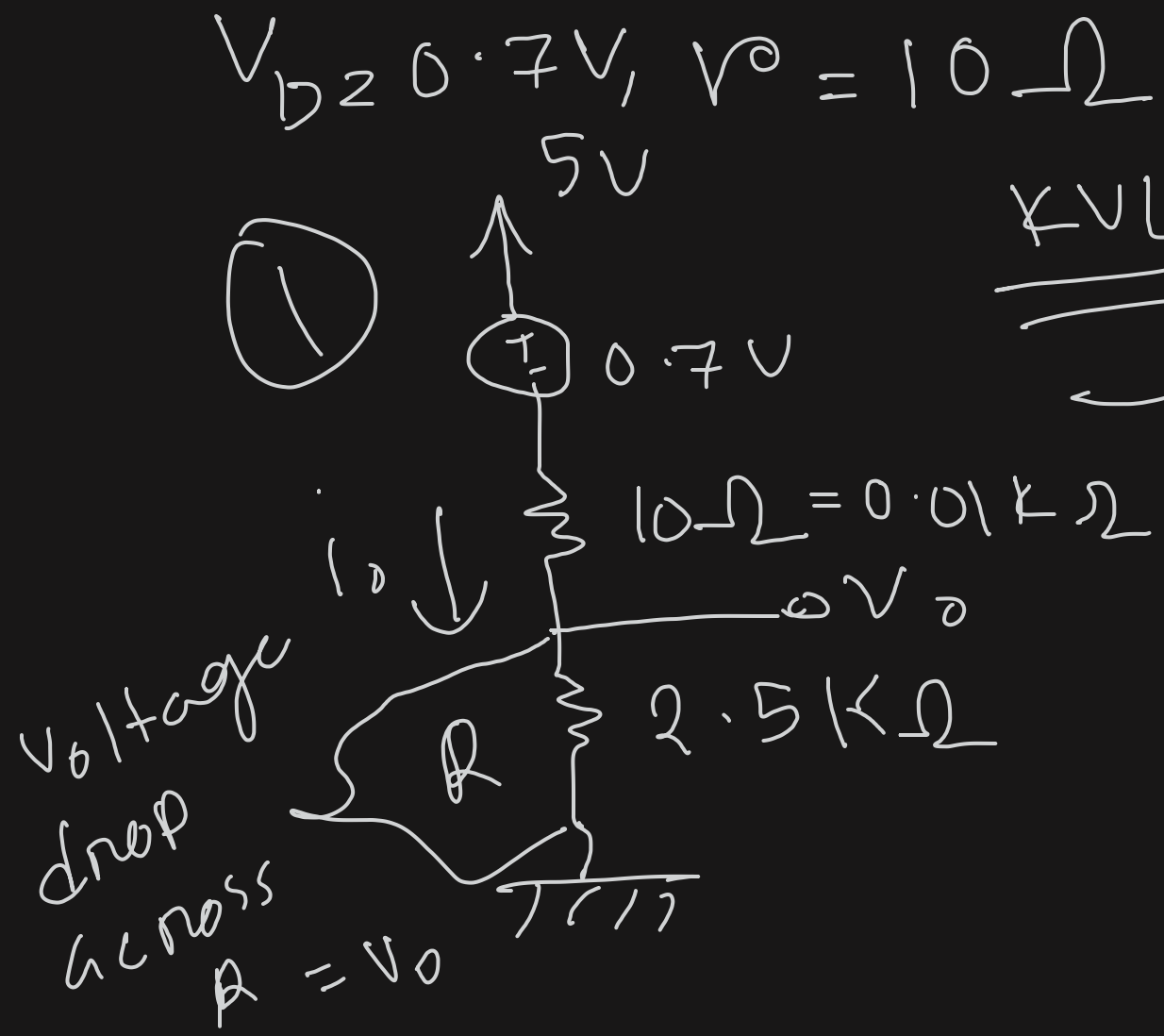


$$V_o = (5 - 0.7)V = 4.3V$$

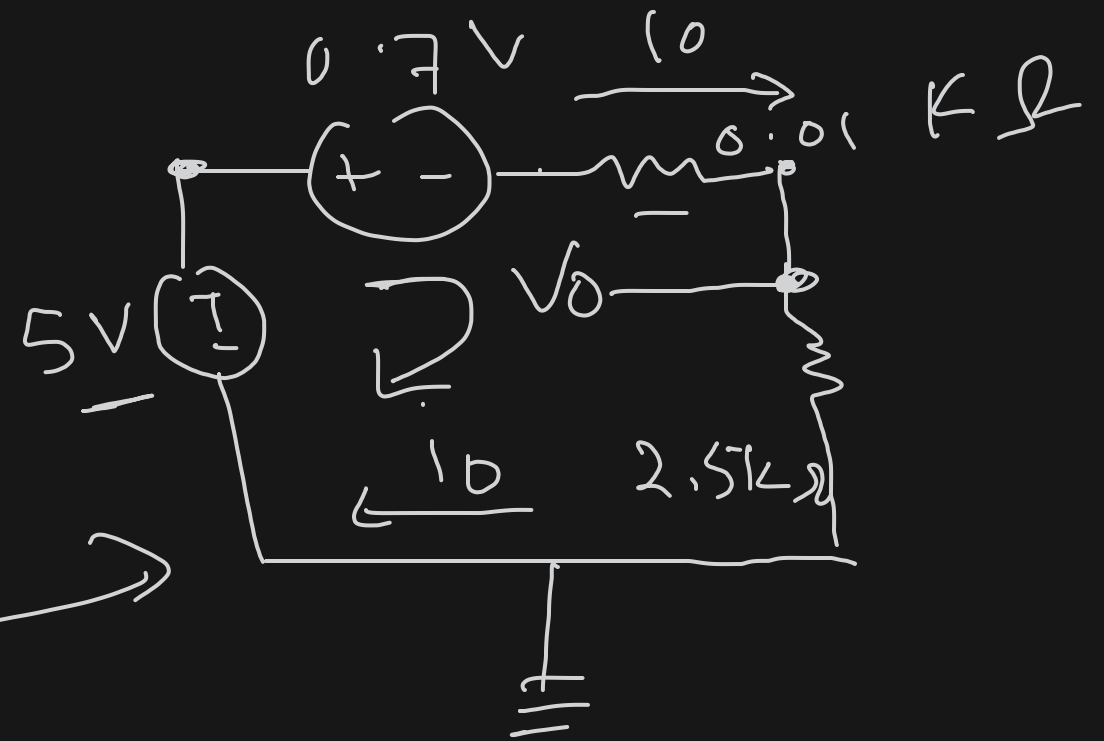
$$\therefore i_o = \frac{V_o - 0}{2.5} = 1.72\text{mA}$$

(iii) CVD + resistance

$V_D = 0.7V$, $R = 10\Omega$



KVL



$0.7 + i_0 \times 0.01$

$+ 2.5 \times i_0 = 5$

$\Rightarrow i_0 = 1.713\ mA$

$\therefore V_0 = i_0 \times R = 4.28\ V$