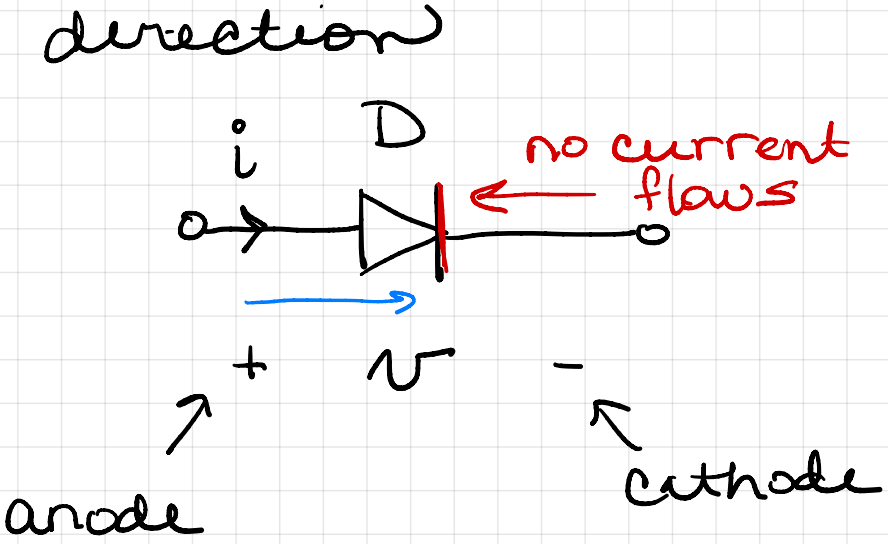
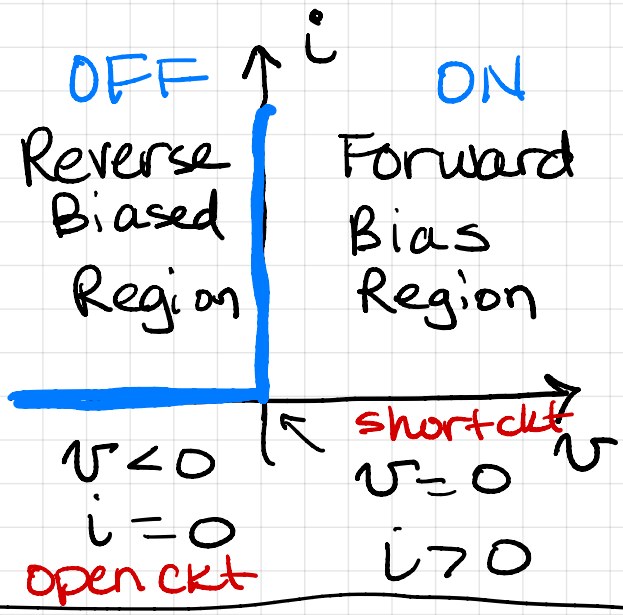
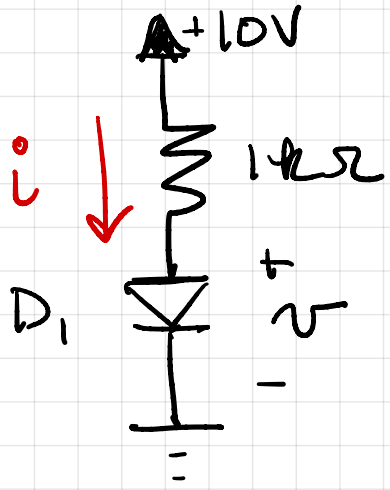
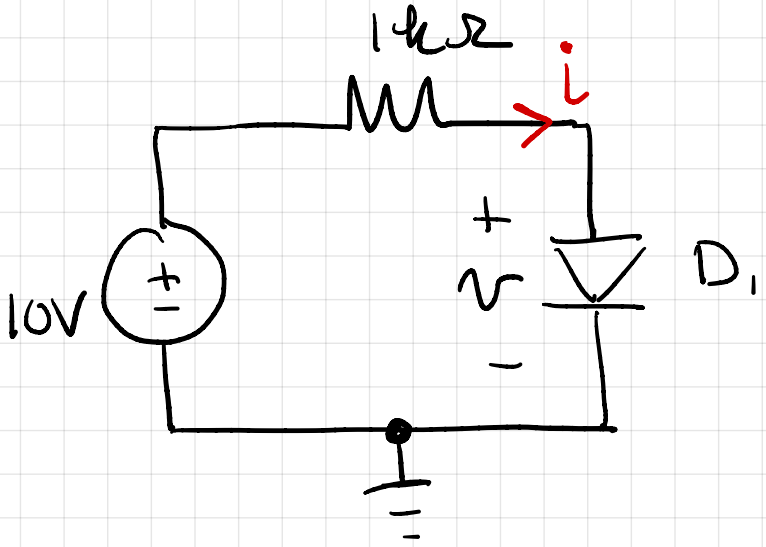
Ideal Diodes

diode is a switch that allows current to flow in one direction but not the other direction

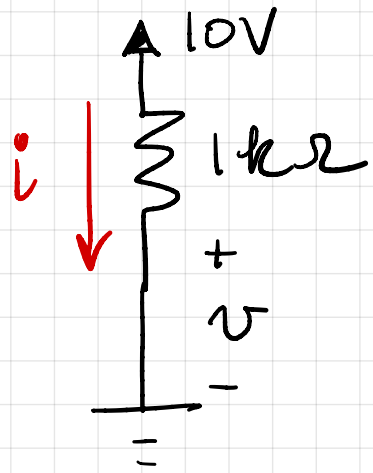








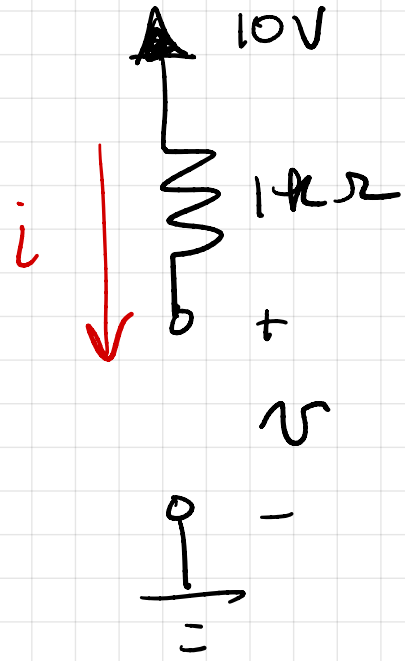
Assume D1 ON



by ohm's law

$$i = \frac{10 - 0}{1 \times 10^3} = 10\text{mA}$$

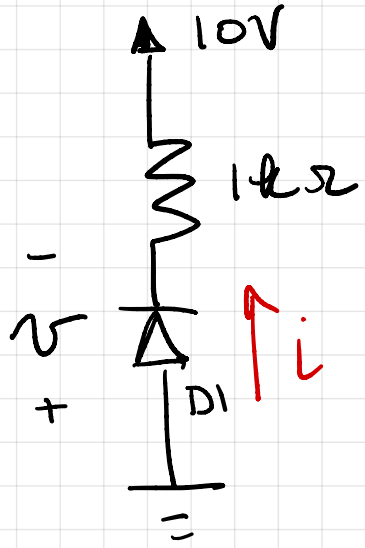
Assume D1 off



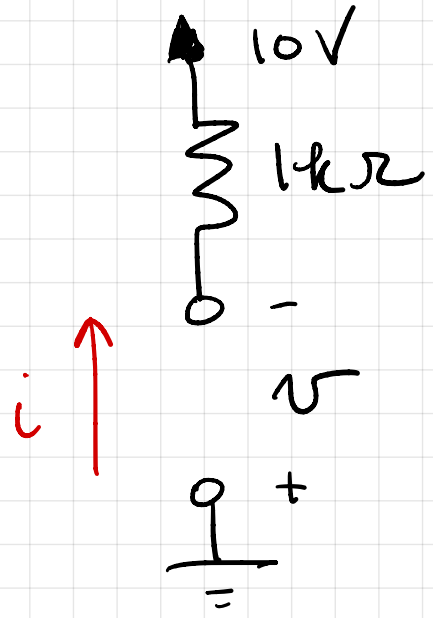
$i = 0$

$v = +10 - 0 = 10V$

since $v > 0$, D1 is not off



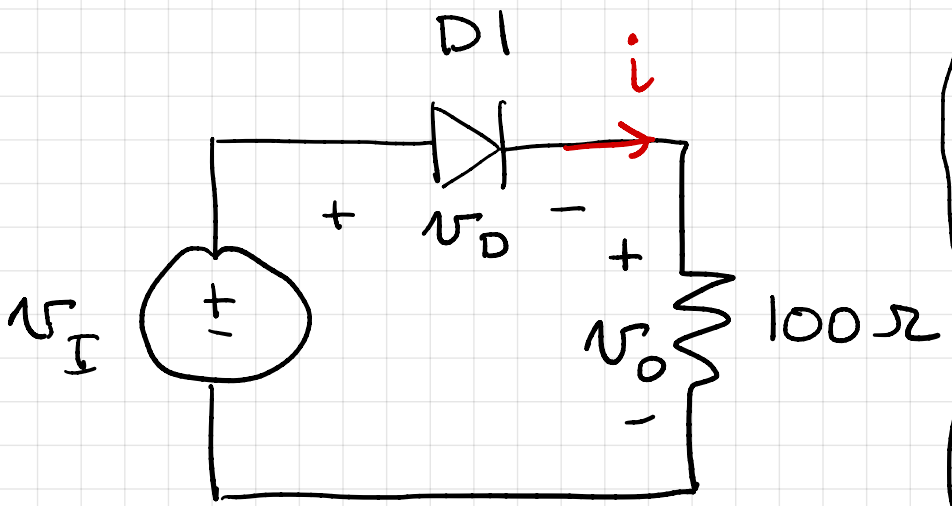
D1 is off

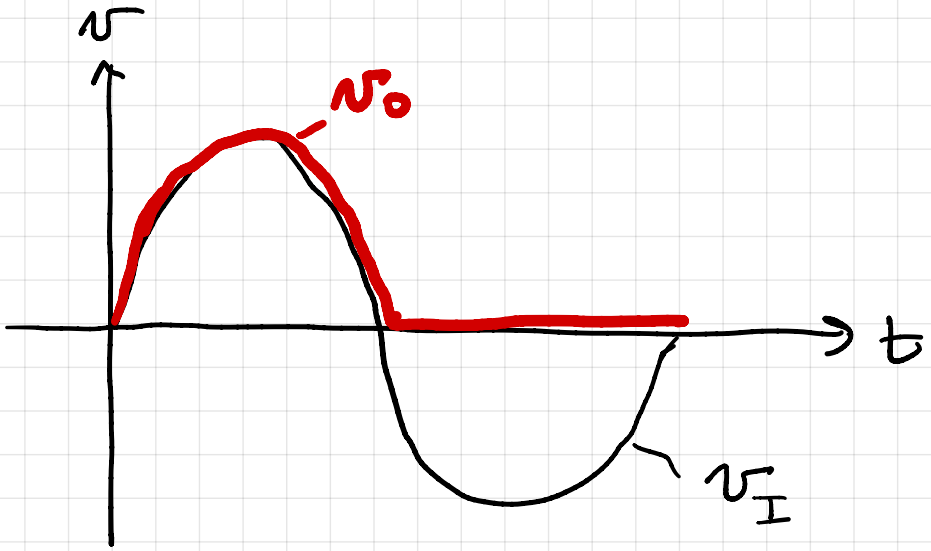


$i = 0$

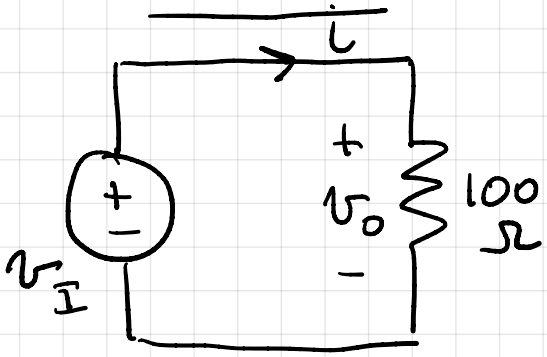
$v = 0 - 10$

$v = -10V$



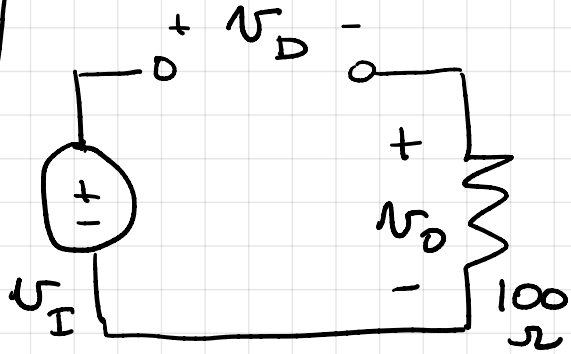


$v_I > 0$



$v_o = v_I$

$v_i < 0$



$v_o = 0$

$v_D = v_I \Rightarrow v_I$ is negative ✓

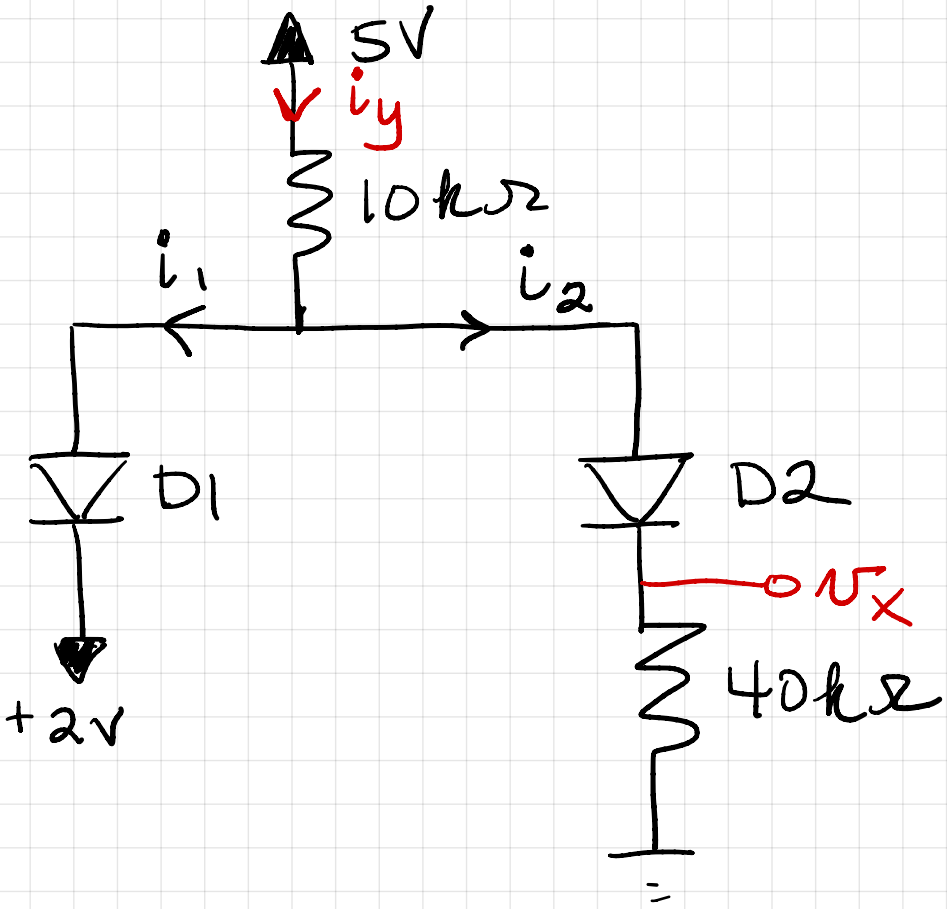
Guesses

D1, D2 ON

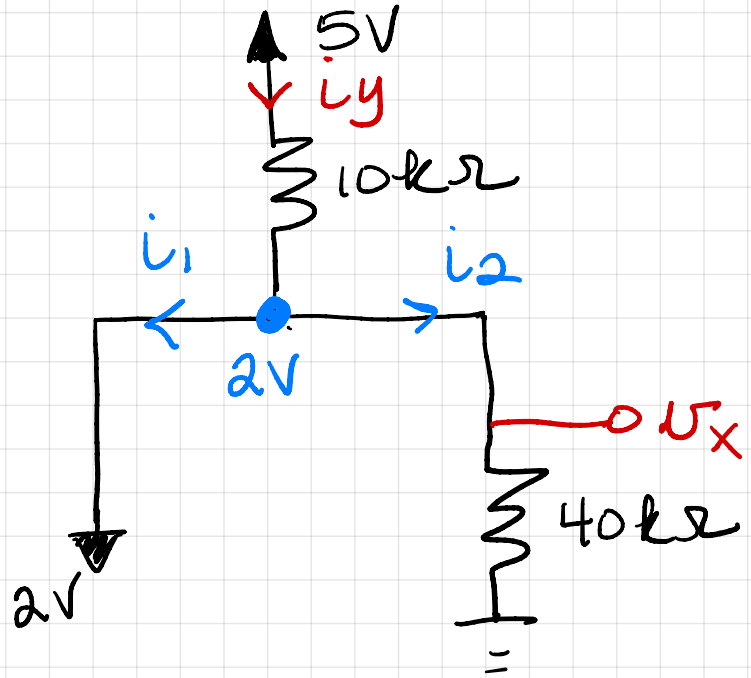
D1, D2 OFF

D1 ON, D2 OFF

D1 OFF, D2 ON



Assume D1, D2 ON ($i_1 > 0$ & $i_2 > 0$)



$$i_y = \frac{5-2}{10 \times 10^3}$$

$$= 0.3\,mA$$

$$v_x = 2V$$

$$i_2 = \frac{v_x}{40 \times 10^3} = 0.05 \text{ mA}$$

by KCL: $i_y = i_1 + i_2$

$$i_1 = i_y - i_2$$

$$i_1 = 0.25 \text{ mA}$$

our assumption checks

$$v_x = 2 \text{ V}$$

$$i_y = 0.3 \text{ mA}$$