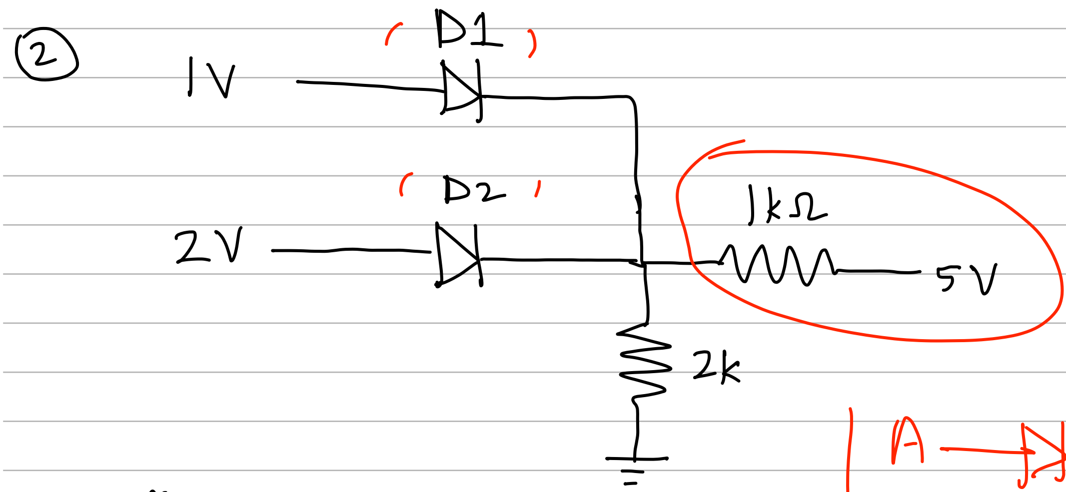
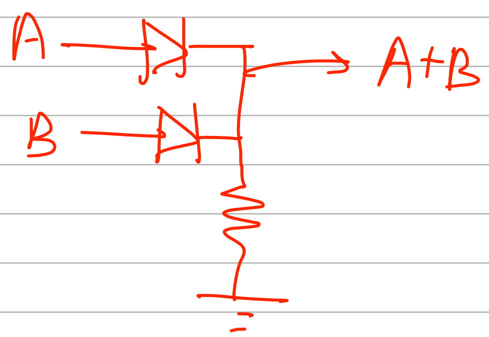
Assumed states examples :



Assume diodes ideal.

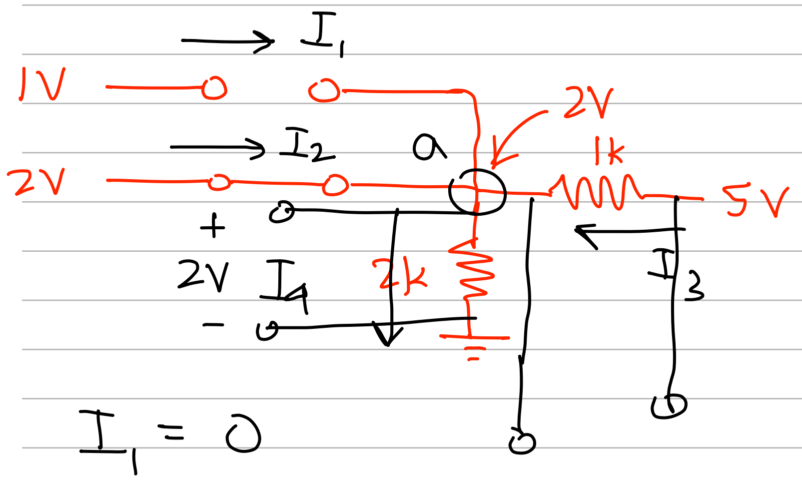


A, B voltage different !

→ higher voltage diode on.

→ other diodes off

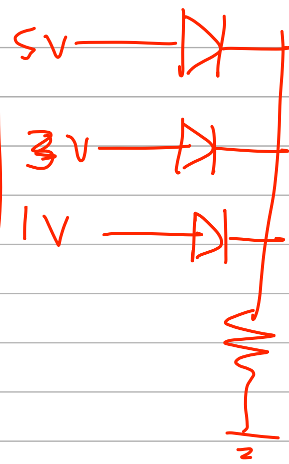
① D2 on, D1 off :



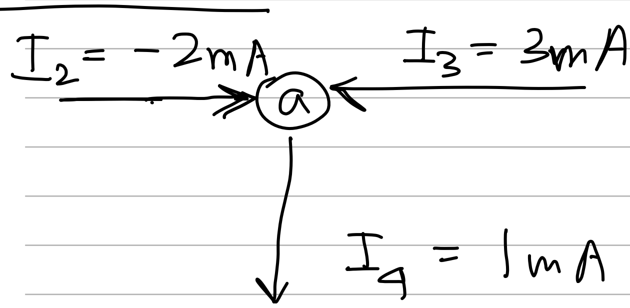
$I_1 = 0$

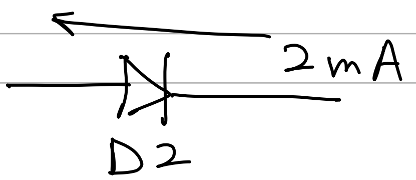
$$I_3 = \frac{5-2}{1k} = 3\ mA$$

$$I_4 = \frac{2-0}{2k} = 1\ mA$$

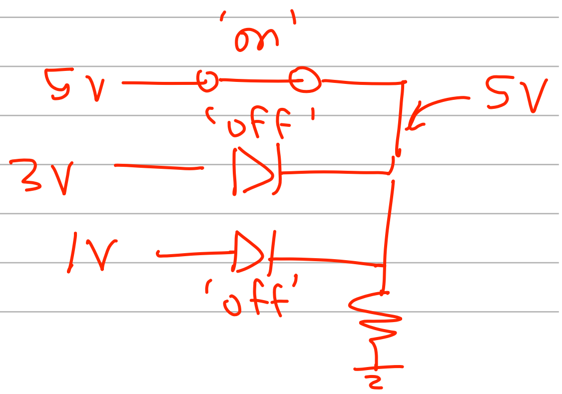


Node a :

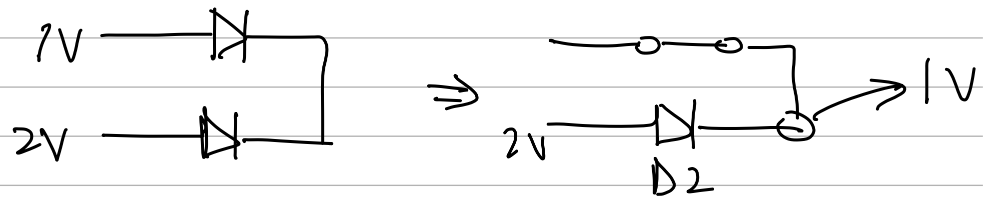




Assumption is : wrong

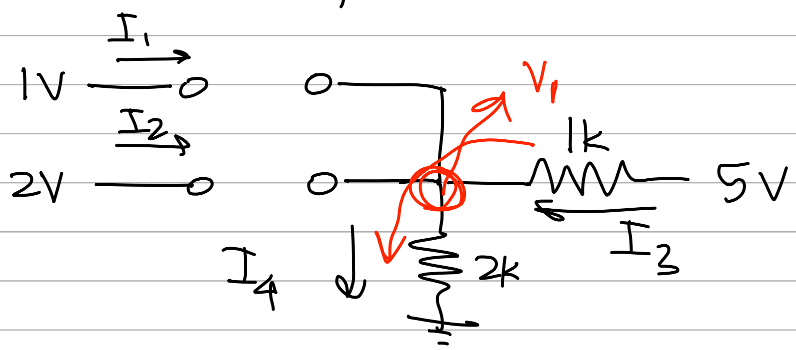


If D1 on:



So D1 cannot be on.

∴ D2 OFF, D1 OFF:



$I_1 = 0$

$I_2 = 0$

$I_3 = I_4 = \dfrac{5}{1+2}$ ✓

KVL:

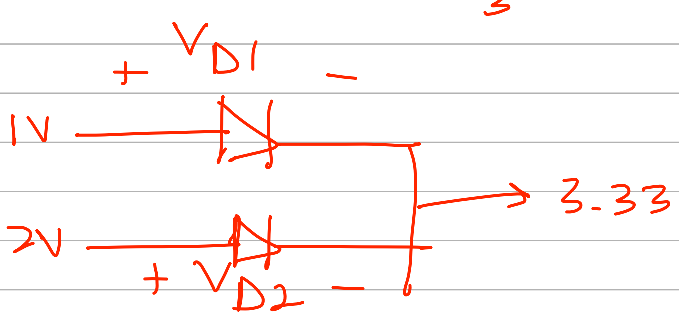
$-5 + 1I_3 + 2I_4 = 0$

$3I_3 = 5$

$I_3 = \dfrac{5}{3}$

$V_1 = 2 \times I_4 = 2 \times \left(\dfrac{5}{3}\right)$

$= \dfrac{10}{3} = 3.33\ V$



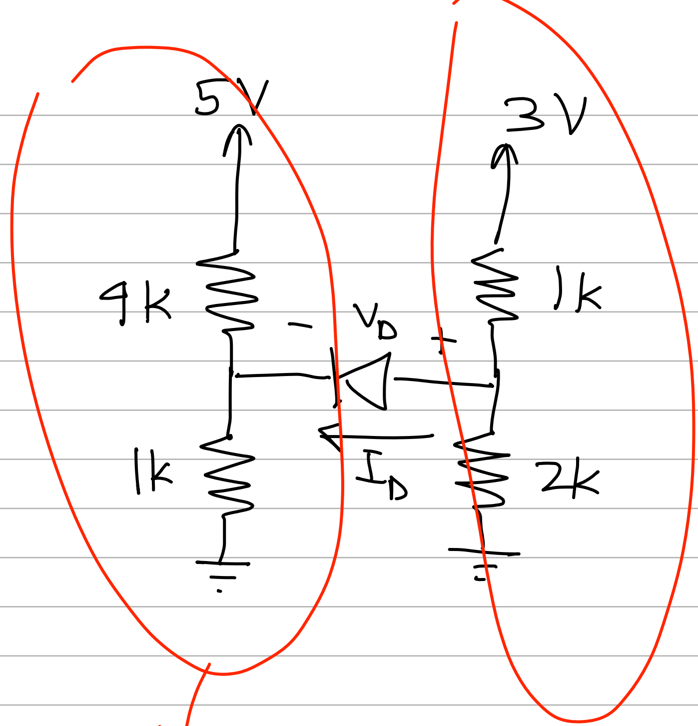
$V_{D1} = 1 - 3.33$

$= -2.33\ V$

$V_{D2} = 2 - 3.33$

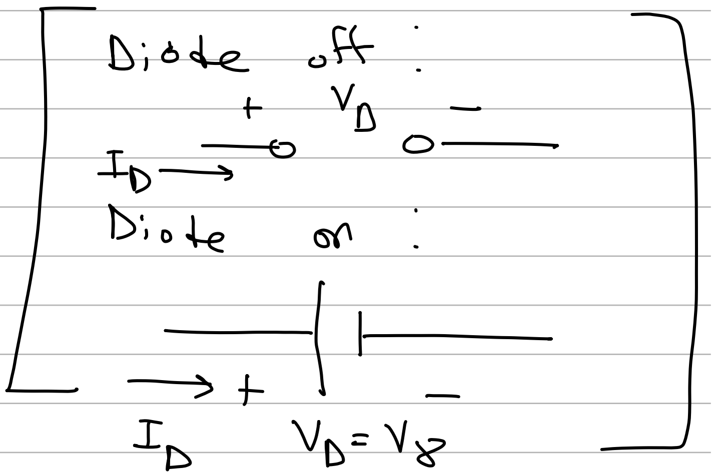
$= -1.33\ V$

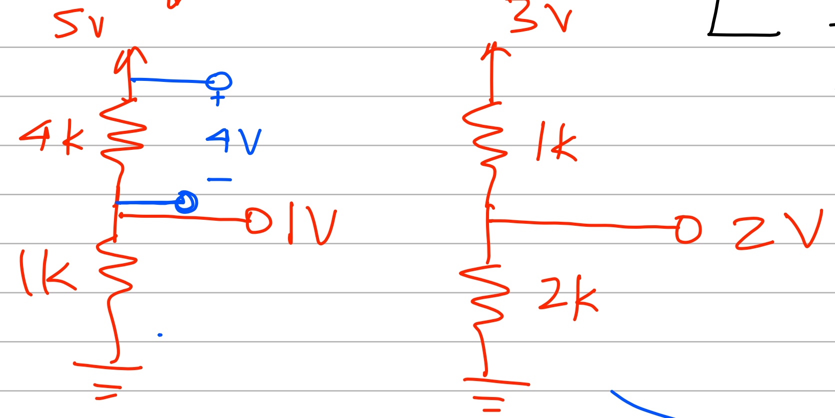
✓ assumption correct



Use CVD model with

$V_\gamma = 0.7V.$





$$\boxed{V_D = 2 - 1 = 1V}$$

$$V_{1k} = \frac{1}{1+2} \times 3 = 1V$$

$$V_{2k} = \frac{2}{1+2} \times 3 = 2V$$

$$V_{4k} = \frac{4}{1+4} \times 5$$

$$= 4V$$

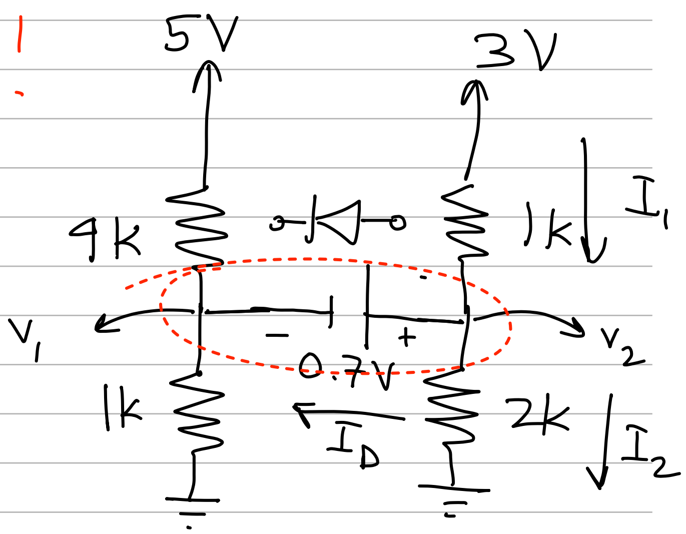
$$V_{1k} = \frac{1}{1+4} \times 5 = 1V$$

∴ Diode should be ON!

Super node

$$\frac{V_1 - 5}{4} + \frac{V_1 - 0}{1} + \frac{V_2 - 3}{1} + \frac{V_2 - 0}{2} = 0 \quad \text{—— (I)}$$

$$V_2 - V_1 = 0.7V \quad \text{—— (II)}$$

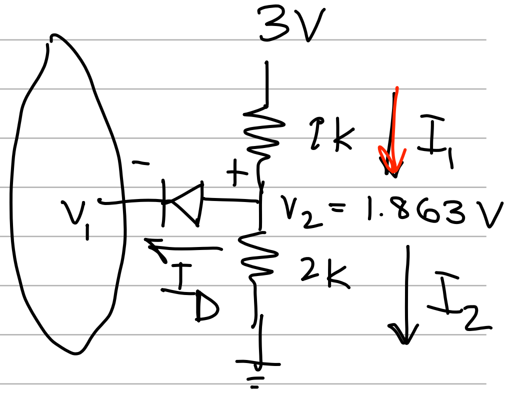


Solving (I) and (II):

$$V_1 = 1.163\ V$$

$$V_2 = 1.863\ V$$

$$V_2 - V_1 = 0.7\ V$$



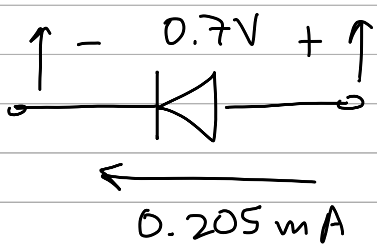
$$I_1 = \frac{3 - V_2}{1k} = 1.163\ mA$$

$$I_2 = \frac{V_2 - 0}{2k} = 0.932\ mA$$

$$I_D = I_1 - I_2$$

$$= 0.205\ mA$$

$$\boxed{I_1 = I_2 + I_D}$$



For 'ON' diode:

→ $V_D = V_\gamma$ [+ve]

→ I_D +ve

Assumption must be changed if:

→ I_D −ve.

For 'OFF' diode:

→ $V_D \geqslant$ −ve

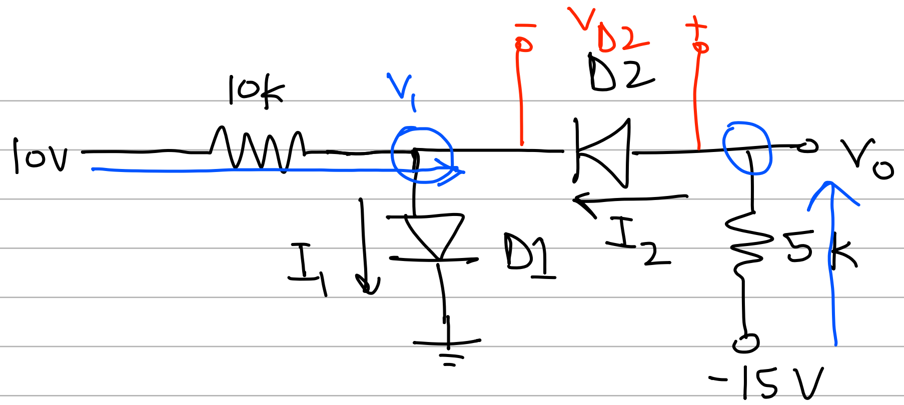
→ I_D '0'

Assumption must be changed if:

→ V_D → +ve [no matter how small or big]

I_D → +ve

Q.



Use CVD

$V_\gamma = 0.7V$

Find V_o, I_1, I_2.

V_1 should be +ve

[$V_1 < 10$ for current to flow across 10 k]

Then V_1 should be greater than 0.

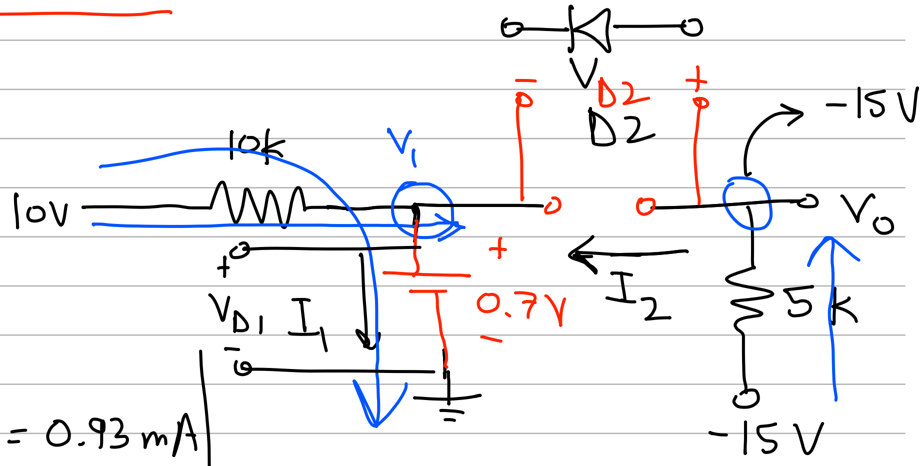
∴ V_{D1} +ve → D1 ON

V_o must be < −15 V for current to flow from −15V.

∴ V_1 should be greater than V_o

∴ V_{D2} −ve

① D1 ON, D2 OFF:



$I_2 = 0$

$I_1 = \frac{10 - 0.7}{10} = 0.93\,mA$

$V_{D1} = 0.7\,V$

$V_{D2} = (-15) - (V_1)$

$= -15 - 0.7 = -15.7V$

→ −ve

$V_o = -15\,V$

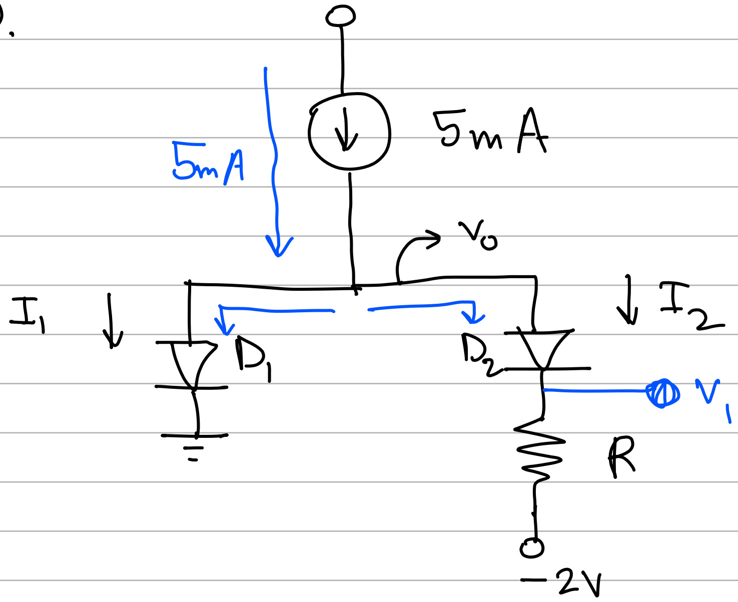
$-10 + 10I_1 + 0.7 = 0$

or, $I_1 = \frac{10 - 0.7}{10}$

$= 0.93\,mA$

✓

Q.



ⓐ $R = 100K$

ⓑ $R = 0.2K$

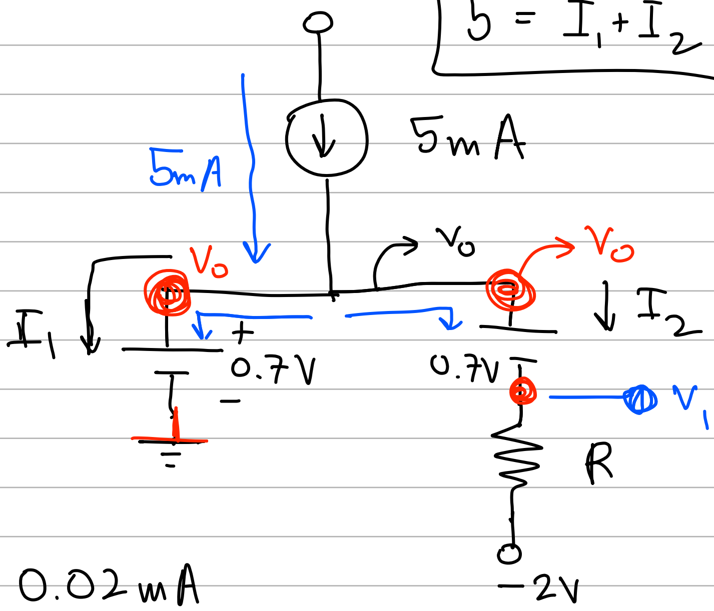
Use CVD model with

$V_\gamma = 0.7V$

ⓐ 100 K :

Assume both diodes ON :

$\boxed{5 = I_1 + I_2}$



$V_o = 0.7V$

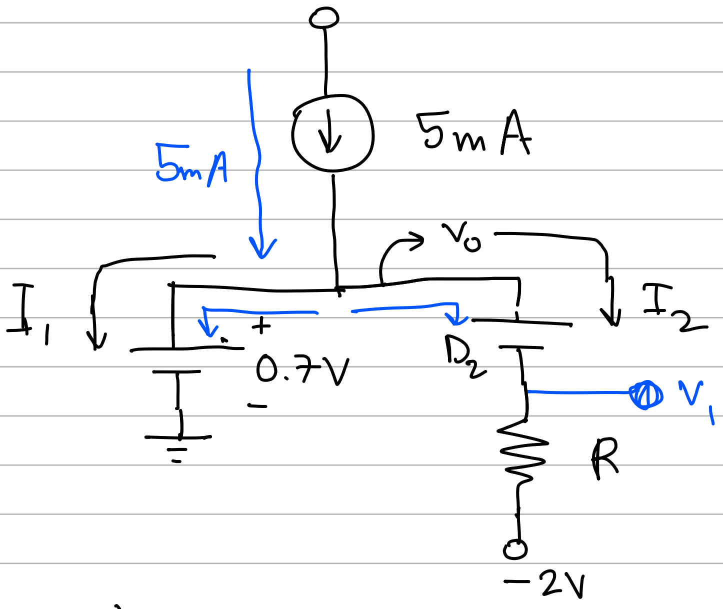
$V_o - V_1 = 0.7V$

$V_1 = 0V$

$$I_2 = \frac{0 - (-2)}{100} = 0.02\,mA$$

$$I_1 = 5 - I_2 = 4.98\,mA$$

(b) $R = 0.2\,k$

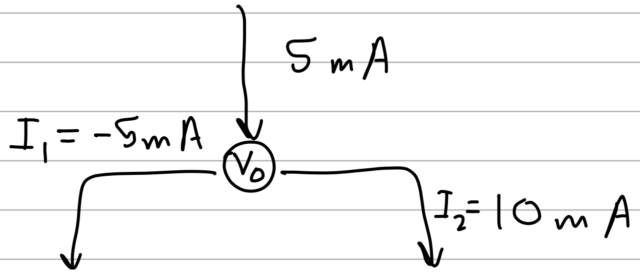


$V_o = 0.7\,V$

$V_1 = 0\,V$

$$I_2 = \frac{0-(-2)}{0.2}$$

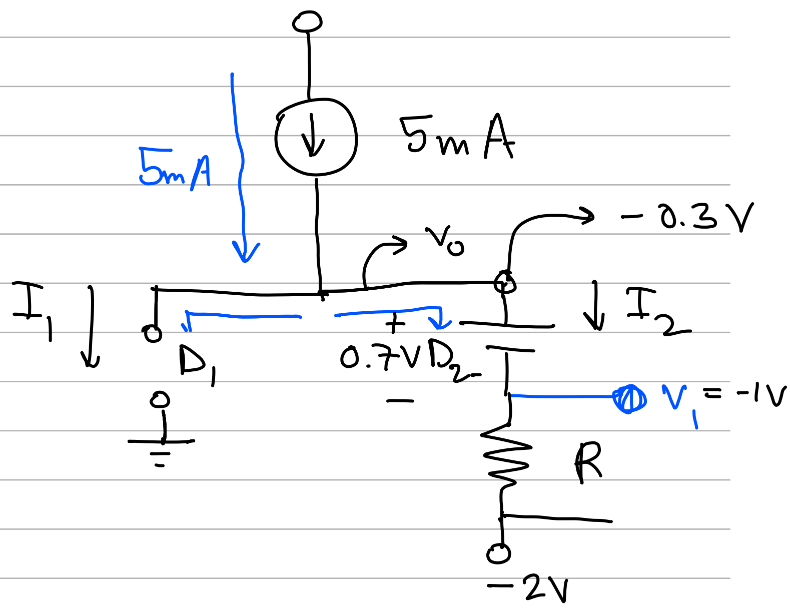
$$= \frac{2}{0.2} = 10\ mA$$



Then $I_{D_1} \rightarrow$ −ve. Assumption wrong

↳ D1 ⟶ assumption change : 'ON' to 'OFF'

D_1 off, D_2 ON :



$I_1 = 0 = I_{D1}$

$I_2 = 5\,mA = I_{D_2}$

$V_R = 0.2 \times 5$

$= 1\,V$

$V_1 - (-2) = 1V \Rightarrow V_1 + 2 = 1\,V$

$V_1 = 1 - 2 = -1\,V$

$V_o = -1V + 0.7V = -0.3\,V$

$V_{D_1} = V_o - 0 = -0.3\,V$

$V_{D_2} = 0.7\,V$

$I_{D_1} = 0$

$I_{D_2} = 5\,mA$

Neamann chapter-2 exercise, lots of diode assumed states problem.