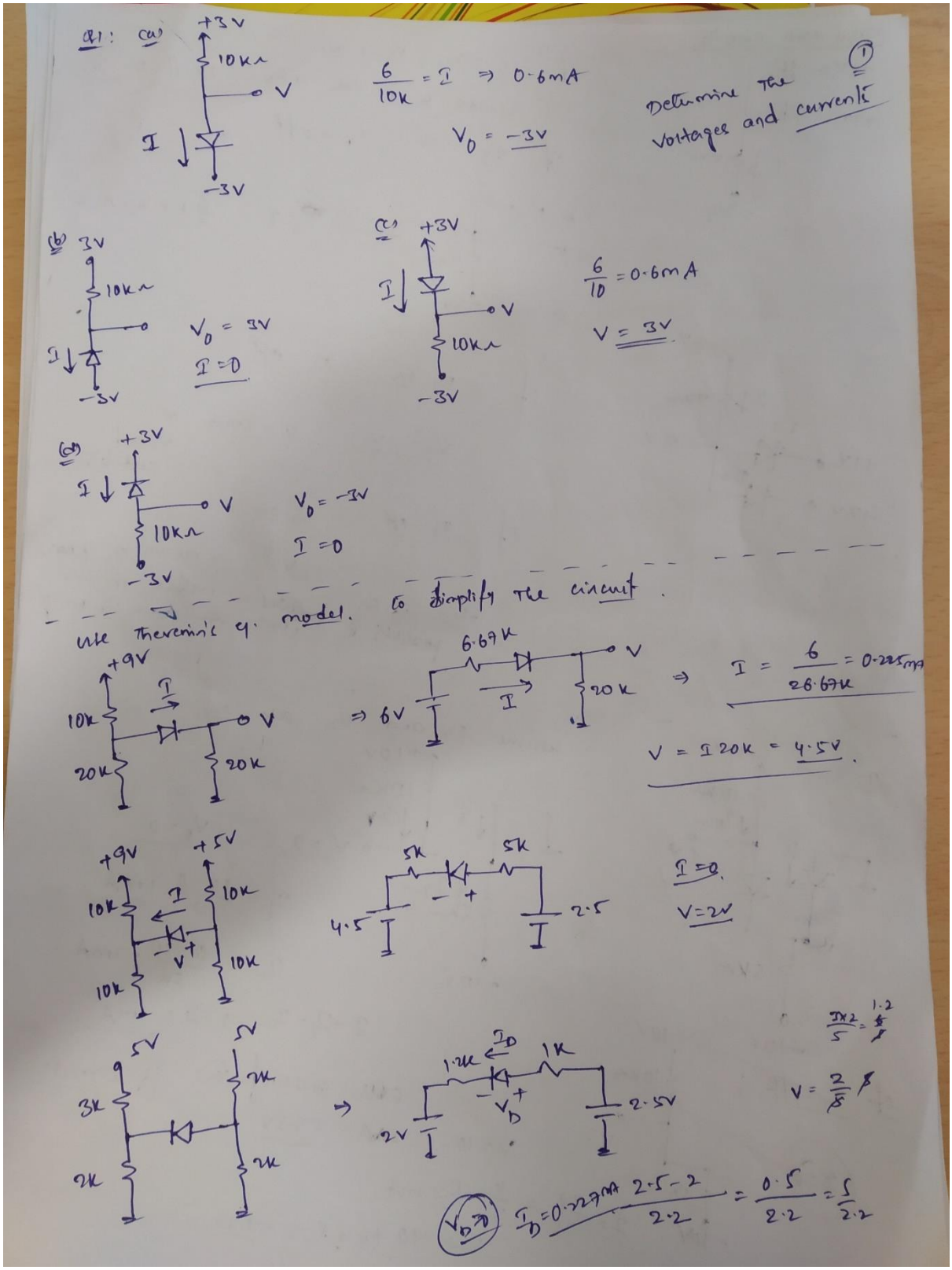
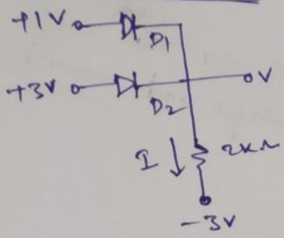
Problems on diode circuits:



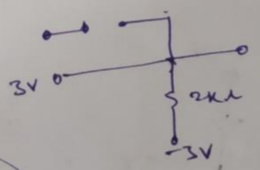
two diode circuits



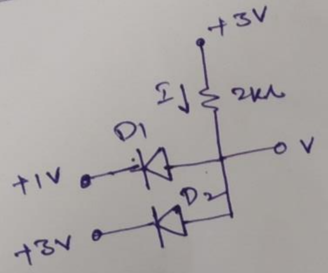
if $D_1 \to$ on $D_2 \to$ on

results to a case where 1V ∥ 3V ✗

if $D_2 \to$ on $D_1 \to$ off ✓



$V = 3V$ ✓ $I = \frac{6}{2} = 3mA$ ✓



if D_1 on D_2 off

$V = 1V$ $I = 1mA$ ✓

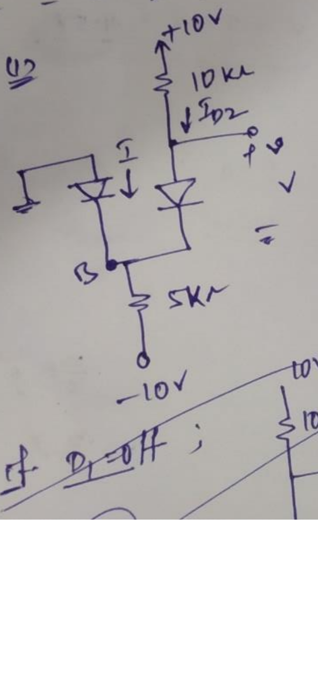
valid condition ✓

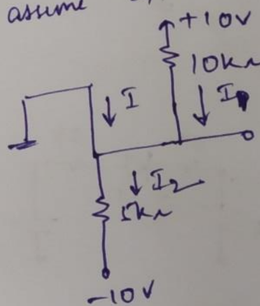
if D_1 off D_2 on

V = 3V → means D_1 is on without means

there is a possibility of practical issue on assuming wrong

assume D_1 and D_2 are on.





$V = 0$ $V_B = 0$

$I_1 = \frac{10-0}{10} = 1mA$

$I_2 = \frac{0+10}{5k} = 2mA$

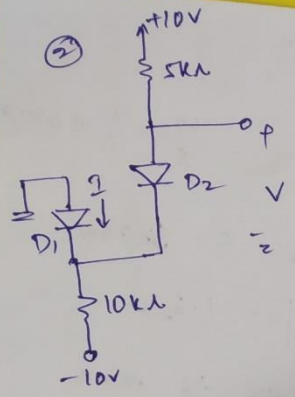
$I + I_1 = I_2 \Rightarrow I = 1mA$

our assumption is correct

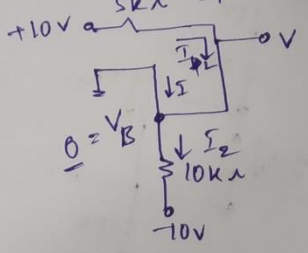
if D_1 off ;

~~$V = 10 - 13.3mA = -3.3V$~~

(2)



Case 1: D_1 = on ; D_2 = on ;



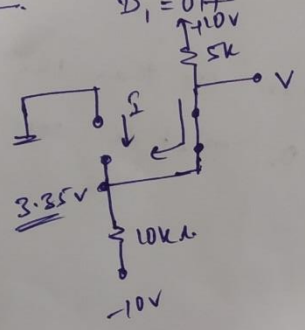
$I_1 = \frac{10-0}{5k} = 2mA$.

$I_2 = \frac{10}{10k} = 1mA$.

$I + 2 = 1 \Rightarrow I = -1mA$

The assumption is wrong which is not possible

Case 2: D_1 = off D_2 = on.

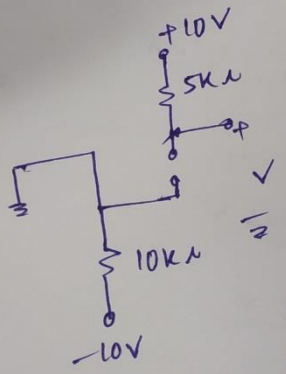


$I_1 = I_2 = \frac{20}{15} = 1.33mA$.

$V = 10 - 5k(1.33m) \Rightarrow 10 - 6.65 = 3.35$

Then; D_1 = off since voltage at cathode is more positive than the anode and the assumption correct

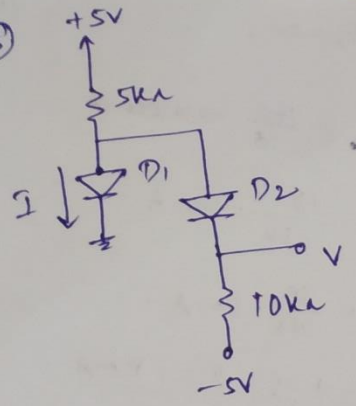
Case 3:



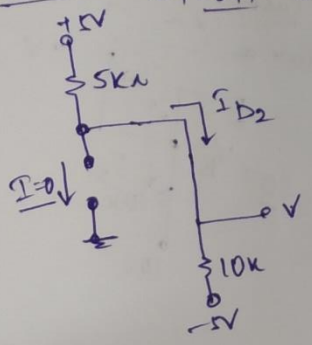
D_2 Anode of D_2 is more +ve than the cathode then the D_2 must be on then the assumption is wrong.

(2')

③



Case 1: D_1 = off D_2 = on



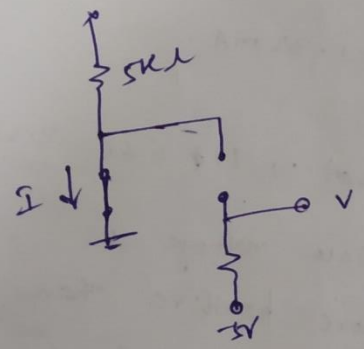
$I_{D_2} = \frac{10}{15} = \frac{2}{3} = 0.66mA$

$V = 5 - 5k(0.66)$

$\boxed{V = 1.6\ V}$

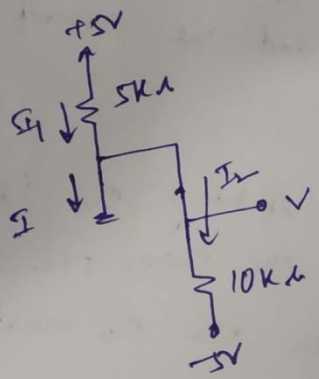
Hence anode of D_1 is more +ve than cathode then D_1 must be on.

Case 2: D_1 = on ; D_2 = off



D_2, Anode is more +ve than the cathode then D_2 must be on

Case 3:



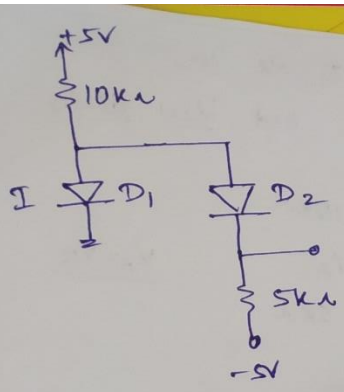
$I_1 = \frac{5-0}{5K} = 1mA.$

$I_2 = \frac{5}{10} = 0.5mA.$

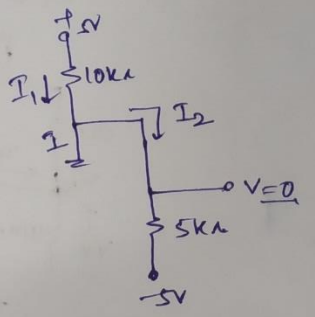
$I + 0.5 = I_1$

$I = 0.5mA$ ✓

$V = 0\ V.$



Case 1: D_1 and D_2 are on. (3)



$I_1 = \frac{5}{10} = 0.5mA$

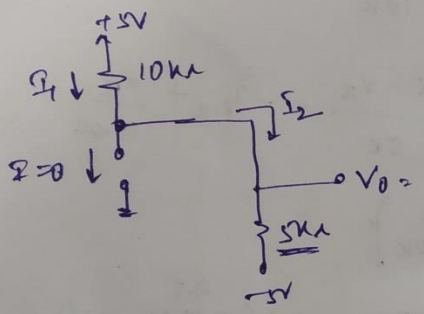
$I_2 = \frac{5}{5} = 1mA$

$I_1 = I + I_2$

$0.5 = I + 1 \Rightarrow I = -0.5mA$

which is not possible

Case 2: $D_1 \rightarrow$ off $\quad D_2 \rightarrow$ on



$I_1 = I_2 = \frac{10}{15} = 0.66mA$.

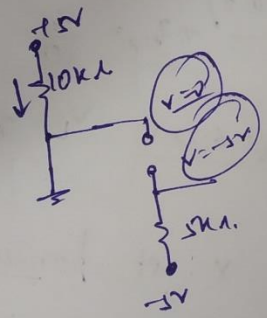
$V_0 = 5 - 10k(0.66mA) =$ ✓

$= 5 - 6.6 = -1.67V$ ✓

$V_0 = 5k \times (0.66) - 5$

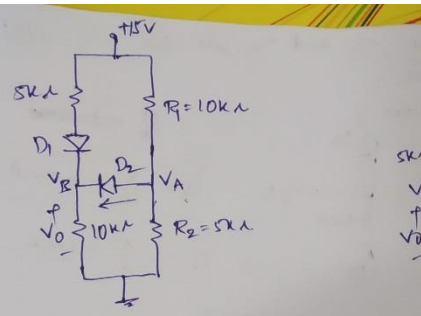
$= 3.3 - 5 = -1.6$

Case 3: $D_1 =$ on $\quad D_2 =$ off.

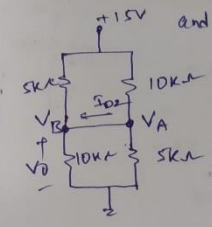


$I_1 = I = \frac{5}{10} = 0.5mA$.

Anode are than the cathode hence D_2 must be (ON). not a valid condition



D1 and D2 are on and ideal diodes.



$V_A = V_B$

$$\frac{15}{10k} - \frac{V_A}{10k} - \frac{V_A}{5k} = I_{D2} \qquad \frac{15 - V_A}{10k} = I_{D2} + \frac{V_A}{5k} \Rightarrow$$

$$\frac{15 - V_A}{5k} - \frac{V_A}{10k\Omega} + \frac{15}{10k} - \frac{V_A}{10k} - \frac{V_A}{5k} = 0 \qquad \frac{15 - V_B}{5k} = -I_{D2} + \frac{V_B}{10k\Omega}$$

$$15\left[\frac{1}{5k} - \frac{1}{10k}\right] = V_A\left[\frac{2}{5k} - \frac{2}{10k}\right]$$

$$15\left[\quad\right] = V_A\left[\quad\right]$$

$V_A = 7.5\,V = V_B$.

$I_{D2} = 0$

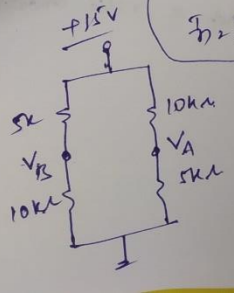
$V_D = 0.7V$.

$$\frac{15 - V_A}{10} = I_{D2} + \frac{V_A}{5} \qquad \frac{15 - (V_B + 0.7)}{5} + I_{D2} = \frac{V_B}{10}$$

$V_B = V_A - 0.7$.

$V_A = 7.6\,V$ $\quad V_B = 6.92\,V$

$I_{D2} = -0.296\,mA$ ✗ not possible inconsistent with the assumption



$$V_B = \frac{15 \times 10k}{15k} = 10V \checkmark$$

$$V_A = \frac{15 \times 5}{15} = 5V \checkmark$$