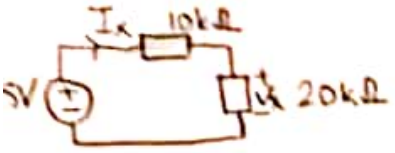
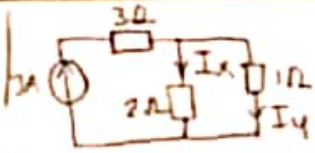


V_x=? $V_x = \frac{15}{10+20} \cdot 20 = 10V$

1/1

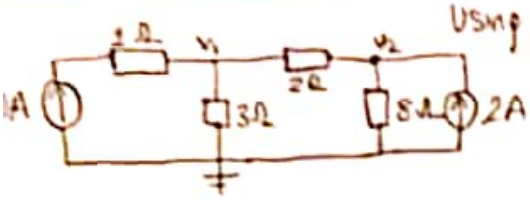


I_x=?

$I_x + I_4 = 3$ $I_x \cdot 2 + I_4 \cdot 1 = 3$

$3I_x = 3$ $I_x = 1$

1/2

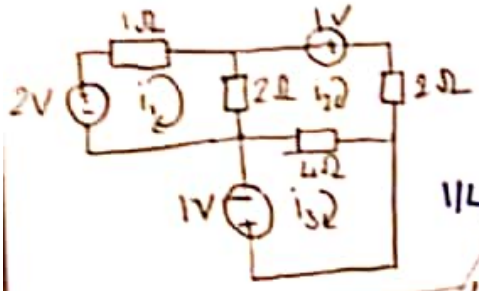


Using node-voltage method find V_1 and V_2.

Node 1: $-1 + \frac{V_1}{3} + \frac{V_1 - V_2}{2} = 0$

Node 2: $\frac{V_2 - V_1}{2} + \frac{V_2}{8} - 2 = 0$

1/3



KVL: $-2 + (1+2)i_1 - 2i_2 = 0$

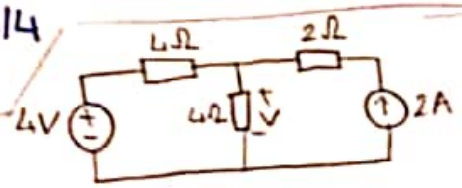
$-1 + (2+4+2)i_2 - 2i_1 - 4i_3 = 0$

$+1 + 4i_3 - 4i_2 = 0$

i_1 i_2 i_3

$\begin{bmatrix} 3 & -2 & 0 \\ -2 & 8 & -4 \\ 0 & -4 & 4 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 2 \\ 1 \\ -1 \end{bmatrix}$

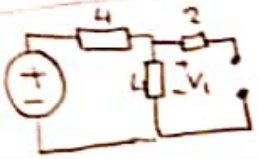
1/4



V? use superposition. 2/1

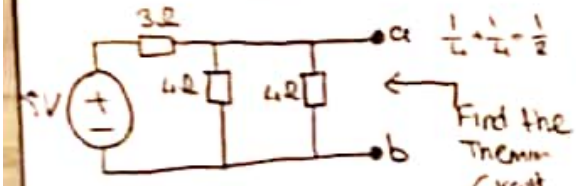
$i_2 = \frac{2}{4+4} \cdot 4 = 1A$. $V_2 = 4 \cdot I_2 = 4$

$4+2=6$.

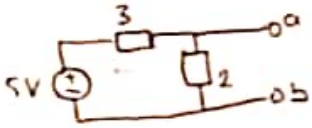


$V_1 = \frac{4}{4.4} \cdot 4 = 2V$ → TAM TERSİ

2/3

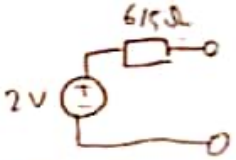


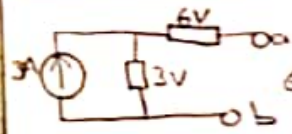
$\frac{1}{4} + \frac{1}{4} = \frac{1}{2}$



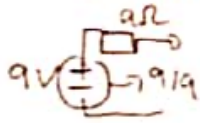
$\frac{5}{2+3} \cdot 2 = 2V$

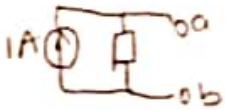
$\frac{1}{3} + \frac{1}{2} = \frac{5}{6} = 6/5$





Find the equivalent Norton Circuit





2/4

Calculate the intrinsic carrier density n_i, for silicon at T=50 and 350K

$n_i = B \cdot T^{3/2} \cdot e^{-E_g/2kT}$

$50K = n_i = (7.3 \cdot 10^{15}) 50^{3/2} e^{-1.12/2R50}$

$350K = n_i = (7.3 \cdot 10^{15}) \cdot 350^{3/2} \cdot e$ 3/1

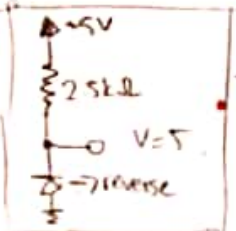
For a silicon crystal doped with boron, what most N_A T=300K 10^6 3/2

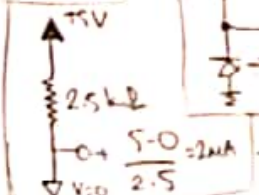
$n_e = n_i / 10^6$

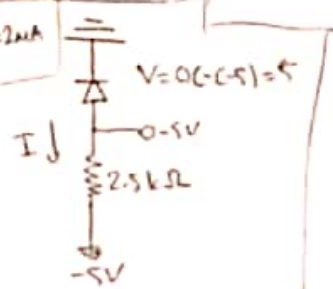
$T = 300K \Rightarrow n_i = 1.5 \cdot 10^{10}$

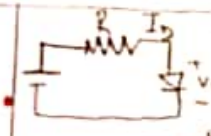
$n_i^2 = n_e \cdot n_p = n_e \cdot N_A$

$n_i^2 = \frac{n_i}{10^6} \cdot N_A \Rightarrow N_A = n_i \cdot 10^6 = 1.5 \cdot 10^{16}$









Find I_D and V_D for the case V_{DD}=5V and R=10kΩ V_D=0.7V

$I_D = \frac{5 - 0.7}{10} = 0.4$