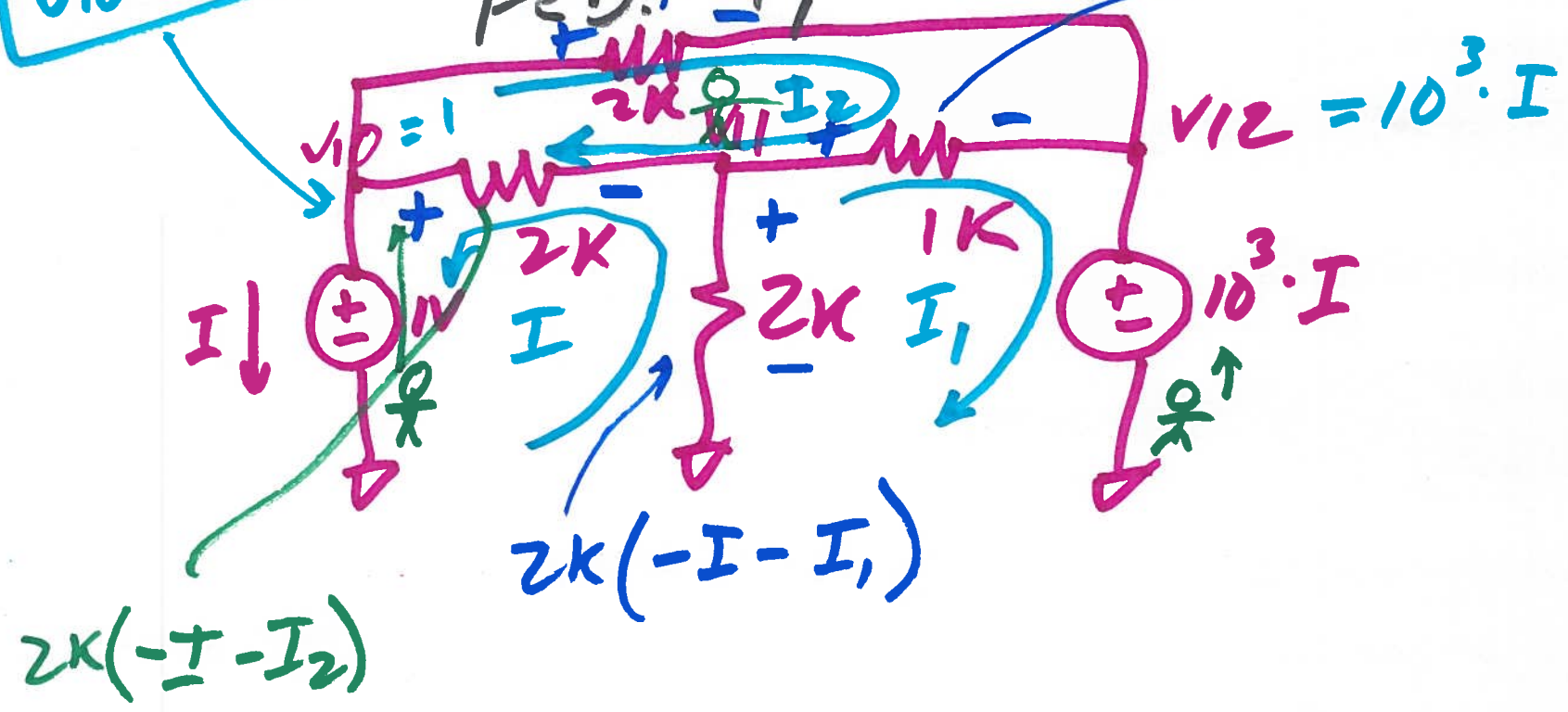


EE 221 Circuits 11

Lecture 4 $2k \cdot I_2 = 1 - 10^3 I$

Feb. 4, 2019 $1k(I_1 - I_2)$

$V_{10} = 1V$



1)

$$2k \cdot I_2 = 1 - 10^3 I$$

$$1V - 2k(-I - I_2) - 2k(-I - I_1) = 0$$

$$10^3 I + 1k(I_1 - I_2) - 2k(-I - I_1) = 0$$

$$2kI_2 + 0 \cdot I_1 + 10^3 I - 1 = 0$$

$$2kI_2 + 2kI_1 + 4kI + 1 = 0$$

$$-1kI_2 + 3kI_1 + 3kI + 0 = 0$$

$$I = 2I_2 + 1\mu A \quad \leftarrow \quad 2I_2 + I - 1\mu A = 0$$

$$2I_2 + 2I_1 + 4I + 1\mu A = 0$$

$$-I_2 + 3I_1 + 3I = 0$$

$$2I_2 + 2I_1 + 4(1\text{mA} - 2I_2) = 0$$

$$-I_2 + 3I_1 + 3(1\text{mA} - 2I_2) = 0$$

$$I_2 + I_1 + 2\text{mA} + 1\text{mA} - 4I_2 = 0$$

$$-3I_2 + I_1 + 3\text{mA} = 0$$

$$I_1 = 3I_2 - 3\text{mA}$$

$$-7I_2 + 3I_1 + 5\text{mA} = 0$$

$$-7I_2 + 9I_2 - 9\text{mA} + 5\text{mA} = 0$$

$$2I_2 - 6.5\text{mA} = 0$$

$$I_2 = 3.25\text{mA}$$

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$$2kI_2 + 10^3 I - 1 = 0$$

$$1V + 2k(I + I_2) + 2k(I + I_1) = 0$$

$$10^3 I + 1k(I_1 - I_2) + 2k(I + I_1) = 0$$

$$I - 1mA + 2I_2 = 0$$

$$I = 1mA - 2I_2$$

$$1 + 2kI + 2kI_2 + 2kI + 2kI_1 = 0$$

$$1 + 4kI + 2kI_2 + 2kI_1$$

$$1mA + 4I + 2I_2 + 2I_1 = 0$$

$$1mA + 4mA - 8I_2 + 2I_2 + 4I_1 = 0$$

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$$5 \mu\text{A} - 3I_2 + 2I_1 = 0$$

$$I_1 = 3I_2 - 2.5 \mu\text{A}$$

$$I + I_1 - I_2 + 2I + 2I_1 = 0$$

$$3I + 3I_1 - I_2 = 0$$

$$3 \mu\text{A} - 6I_2 + 9I_2 - 7.5 \mu\text{A} - I_2 = 0$$

$$-4.5 \mu\text{A} = -2I_2$$

$$\underline{\underline{I_2 = 2.25 \mu\text{A}}}$$

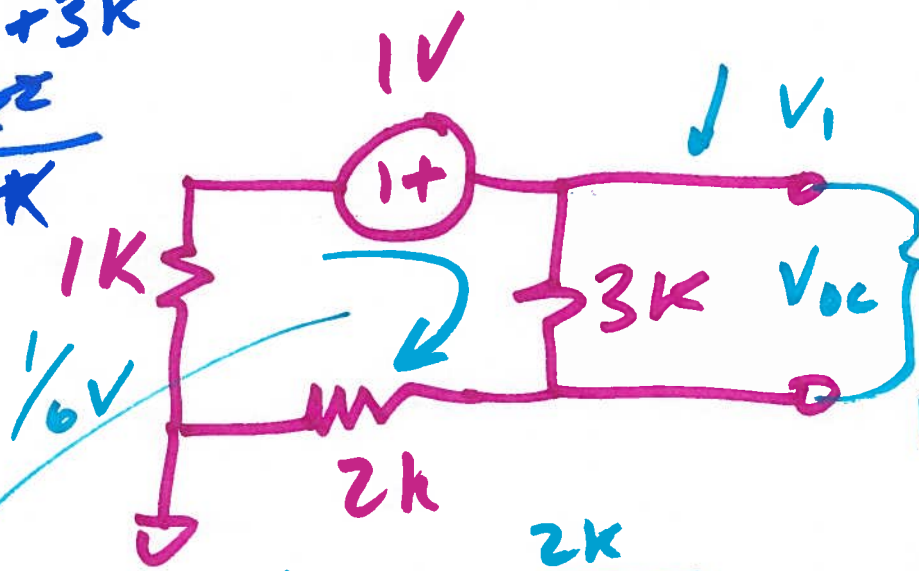
5)

$$\frac{4k \cdot 3k}{4k + 3k} = 1k$$

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$$\frac{12k^2}{7k} = 1.71k$$

$$R_{TH} = 1.5k$$

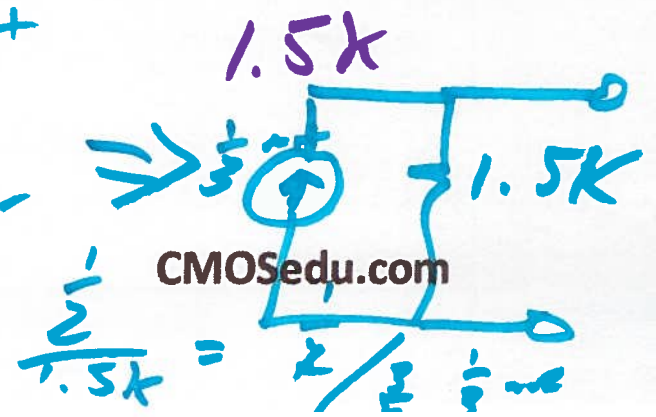
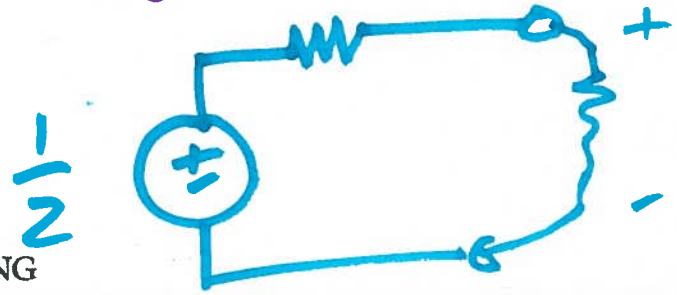
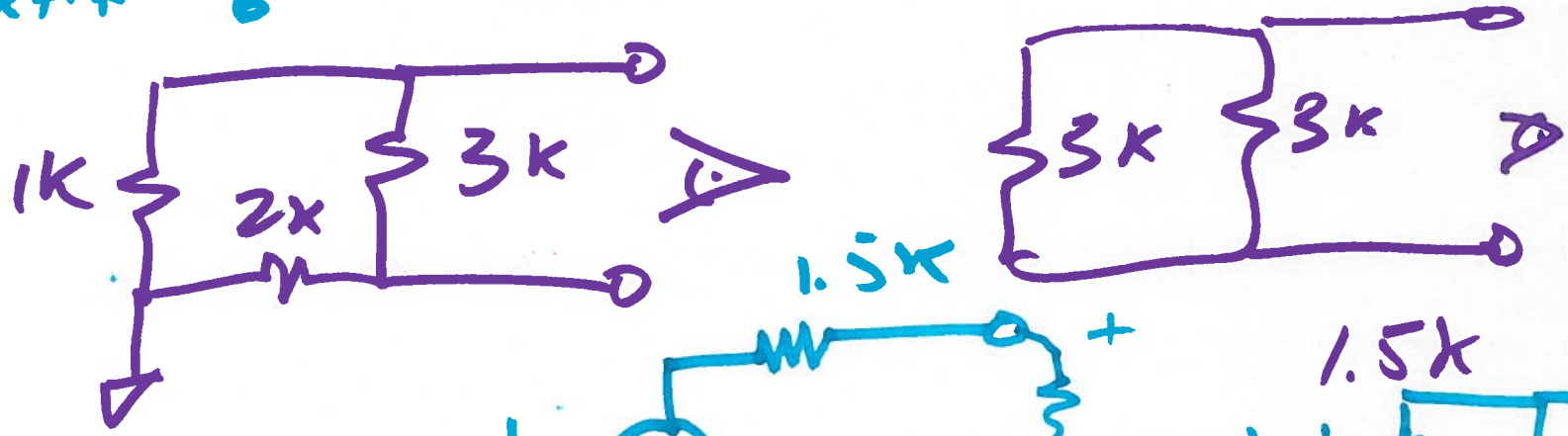


$$V_{OC} = \frac{1 \cdot 3k}{3k + 2k + 1k} = \frac{1}{2} V$$

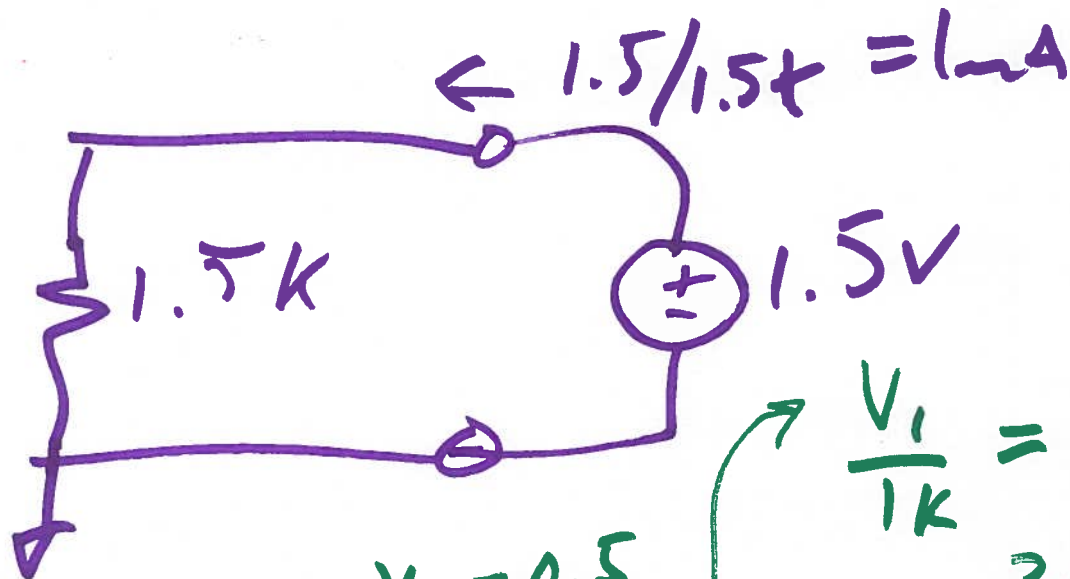
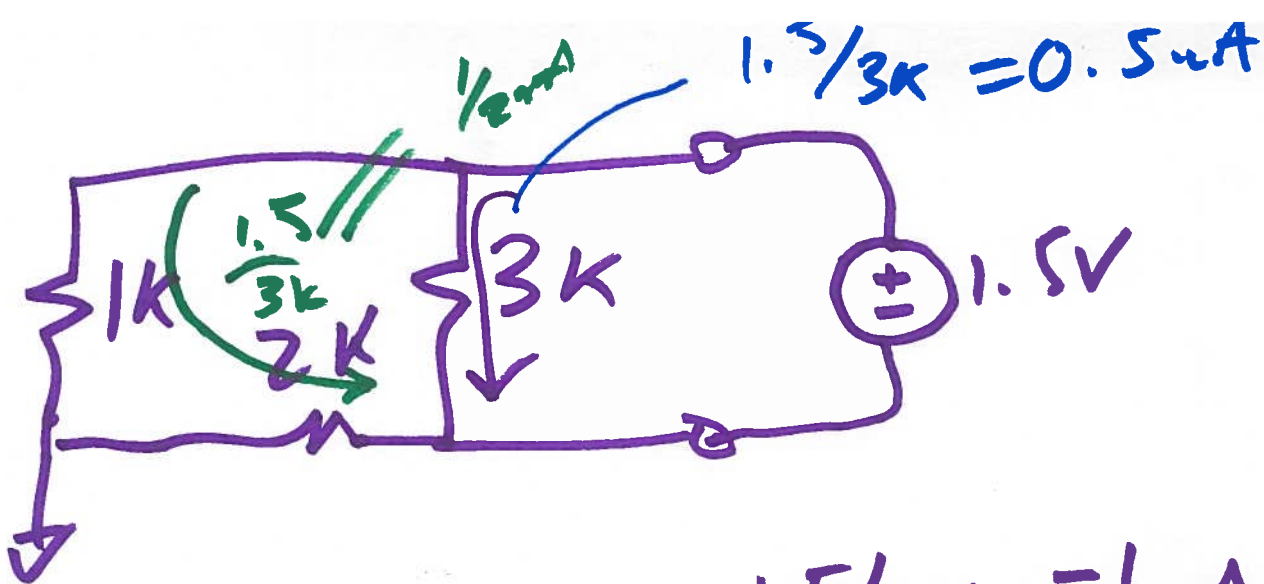
$$V_{OC} = \frac{1}{6} mA \cdot 3k$$

$$\frac{1}{3k + 2k + 1k} = \frac{1}{6} mA$$

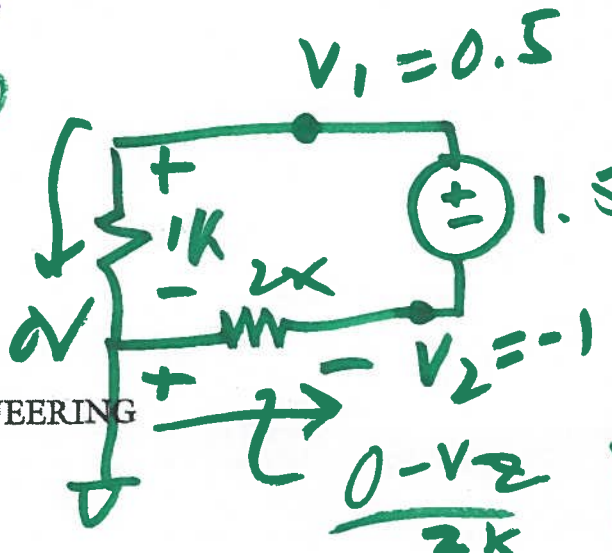
$$\frac{2k}{2k + 3k + 1k} = \frac{1}{6}$$



b)



$V_1 = 0$
 $\frac{V_1}{1k}$



$\frac{V_1}{1k} = \frac{-V_2}{2k}$

$3 + 2V_2 = -V_2$

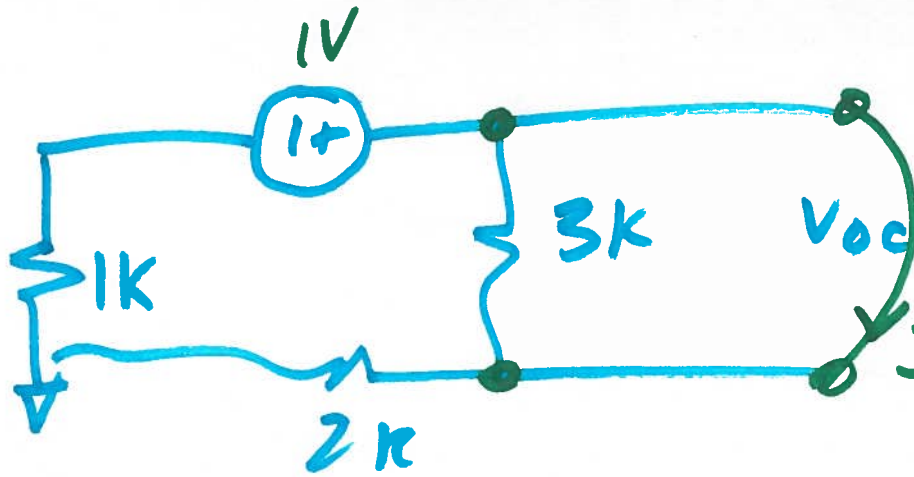
$V_2 = -1V$

$= V_1 - V_2$

$V_1 = 1.5 + V_2$

$V_1 = 0.5V$

7)

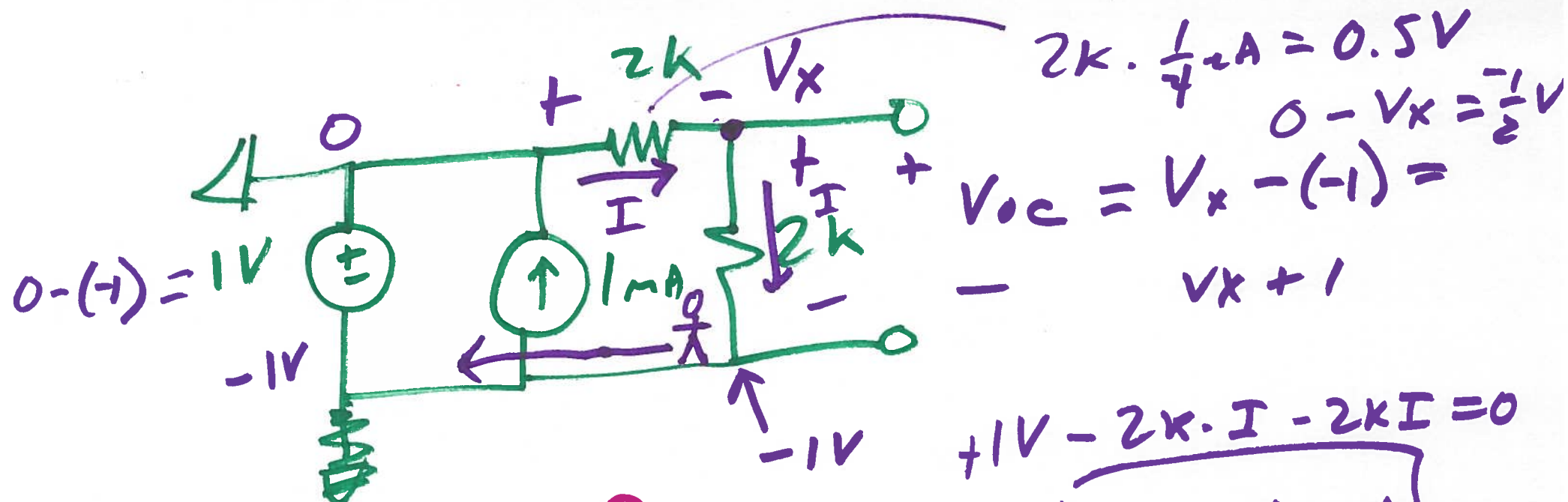


$$R_{TH} = \frac{V_{oc}}{I_{sc}}$$

$$V_{oc} = \frac{1}{2}V$$

$$I_{sc} = \frac{1V}{3k} = \frac{1}{3}mA$$

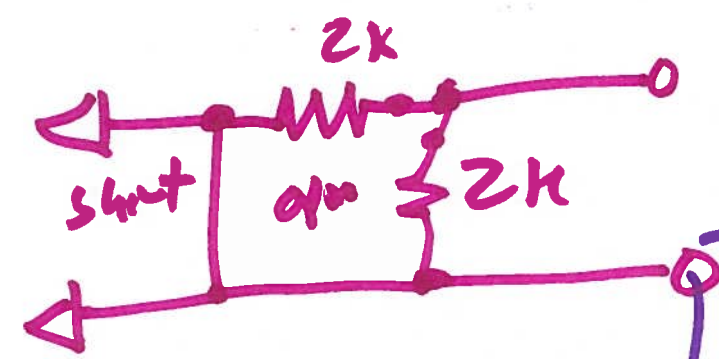
$$R_{TH} = \frac{\frac{1}{2}}{\frac{1}{3}mA} = \frac{3}{2}k\Omega = 1.5k\Omega$$



$R_{TH} = ?$

$$+1V - 2k \cdot I - 2kI = 0$$

$$I = \frac{1}{4} \mu A$$



$R_{TH} = 1k$

$$V_{oc} = -\frac{1}{2}V$$

9)