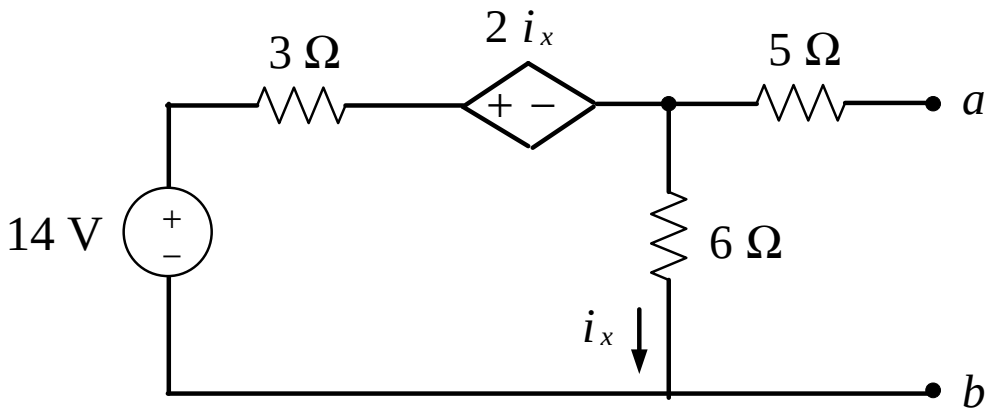
EE 202-01 – Winter 2013(122)

Quiz 3

SER	ID	NAME **KEY**



For the circuit shown above find

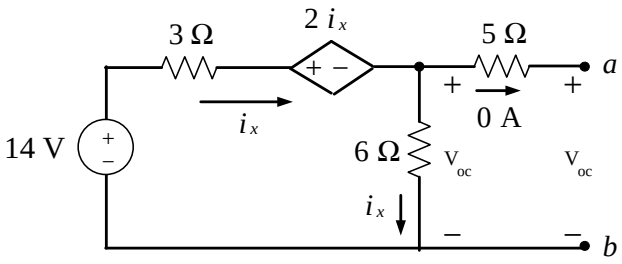
(a) The **open circuit voltage** V_{oc} between **a** and **b** directly
(Do not find short circuit current)

(b) The R_{th} using a test voltage method ?

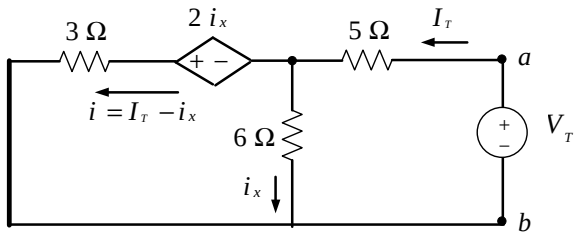
(a) KVL : $-14+3i_x+2i_x+6i_x=0$

$\Rightarrow i_x=\frac{14}{11}$ A

$\Rightarrow V_{oc}=6i_x=\frac{84}{11}=7.6363$ V



(*b*) KCL $\Rightarrow i = I_T - i_x$



KVL on the inner loop1:

$-V_T + 5I_T + 6i_x = 0$

$\Rightarrow V_T = 5I_T + 6i_x$ **(1)**

KVL on the inner loop2:

$-2i_x + 3(I_T - i_x) - 6i_x = 0$

$\Rightarrow i_x = \dfrac{3I_T}{11}$ **(2)**

$\Rightarrow$ **From (1) and (2)** $\Rightarrow V_T = 5I_T + 6\left(\dfrac{3I_T}{11}\right)$

$\Rightarrow R_{TH} = \dfrac{V_T}{I_T} = \dfrac{73}{11}\ \Omega$

Extra : Finding Isc (Not included in the grading)

KCL $\Rightarrow i = i_x + I_{sc}$

KVL : KVL on the inner loop

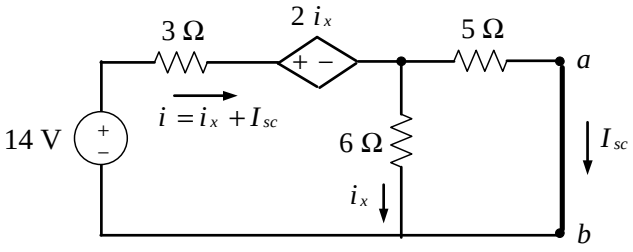
$-14 + 3(i_x + I_{sc}) + 2i_x + 5I_{sc} = 0$

$\Rightarrow 5i_x + 8I_{sc} = 14$ **(1)**

KVL on the inner loop

$-14 + 3(i_x + I_{sc}) + 2i_x + 6i_x = 0$

$\Rightarrow 11i_x + 3I_{sc} = 14$ **(2)**



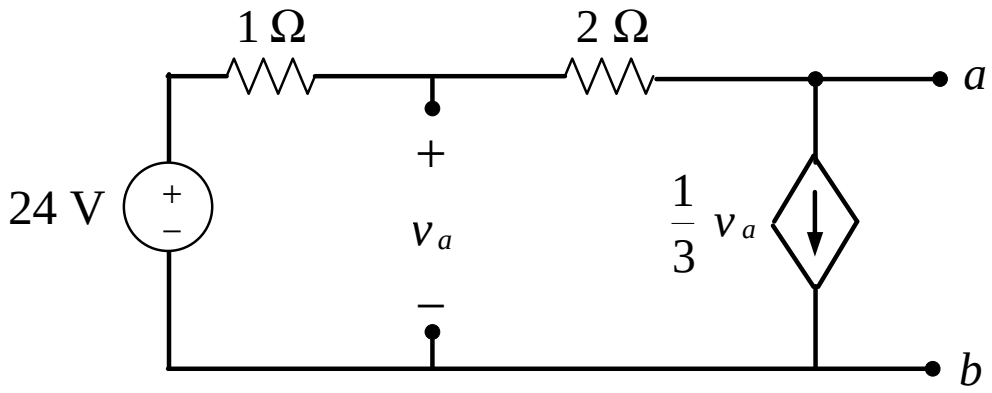
$\Rightarrow$ **From (1) and (2)**

$\Rightarrow I_{sc} = \dfrac{84}{73} = 1.1507$ A

EE 202-02 – Winter 2013(122)

Quiz 3

SER	ID	NAME **KEY**



For the circuit shown above find

(a) The **short circuit current** I_{SC} between a and b directly
(Do not find open circuit voltage)

(b) The R_{th} using a test voltage method ?

(*a*) KCL $\Rightarrow\ i = \frac{1}{3}\ v_a + I_{sc}$

KVL on the outer loop:

$$-24+(1+2)\left(\frac{1}{3}\ v_a + I_{sc}\right) = 0$$

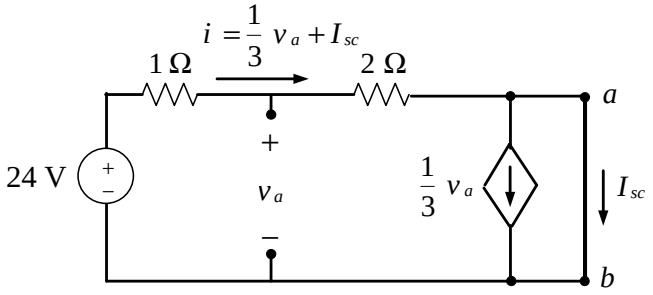
$$\Rightarrow\ I_{sc} + \frac{1}{3}\ v_a = 8 \quad \textbf{(1)}$$

KVL on the inner loop:

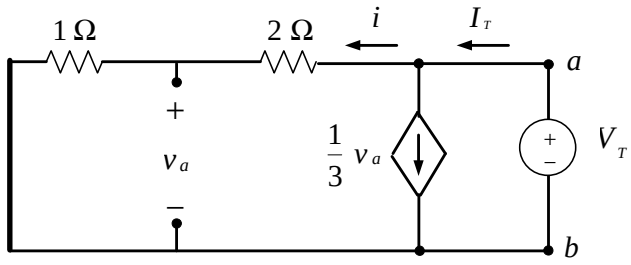
$$-24+(1)\left(\frac{1}{3}\ v_a + I_{sc}\right) + v_a = 0$$

$$\Rightarrow\ \frac{3}{4} I_{sc} + \ v_a = 18 \quad \textbf{(2)}$$

solving (1) and (2) $\Rightarrow I_{sc} = \frac{8}{3} = 2.6667$ A



(*b*) KCL $\Rightarrow I_T = \frac{1}{3} v_a + i$ **(1)**



KVL on the outer loop:

$-V_T + (2+1)i = 0 \Rightarrow i = \frac{V_T}{3}$

KVL on the inner loop:

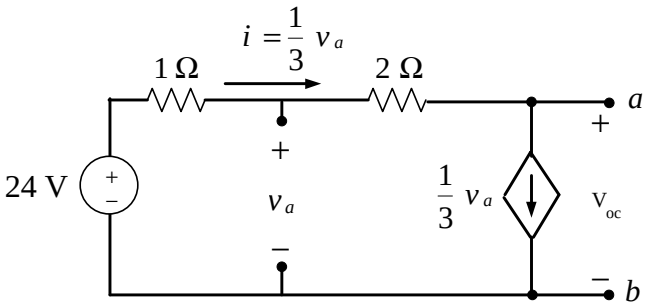
$-v_a + (1)i = 0 \Rightarrow v_a = i = \frac{V_T}{3}$

From (1) $\Rightarrow I_T = \frac{V_T/3}{3} + \frac{V_T}{3}$

$\Rightarrow R_{TH} = \frac{V_T}{I_T} = \frac{9}{4}\ \Omega$

Extra : Finding Voc (Not included in the grading)

KCL $\Rightarrow i = \frac{1}{3} v_a$



KVL on the outer loop:

$-24 + (1+2)\left(\frac{1}{3} v_a\right) + V_{oc} = 0$

$\Rightarrow v_a + V_{oc} = 24$ **(1)**

KVL on the inner loop:

$-24 + (1)\left(\frac{1}{3} v_a\right) + v_a = 0 \Rightarrow v_a = 18$ V

From (1) $\Rightarrow V_{oc} = 24 - v_a = 24 - 18 = 6$ V