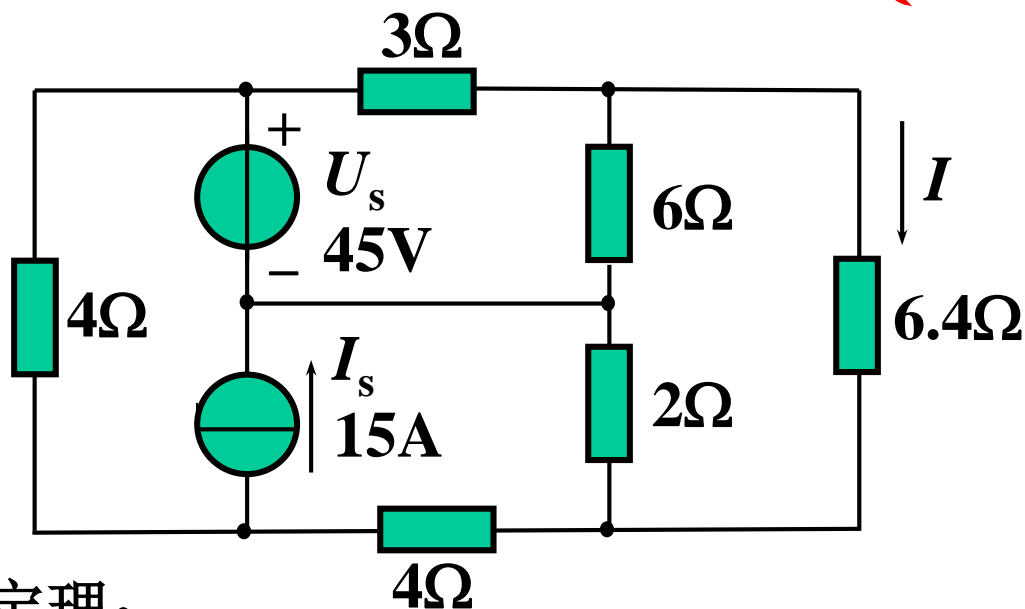
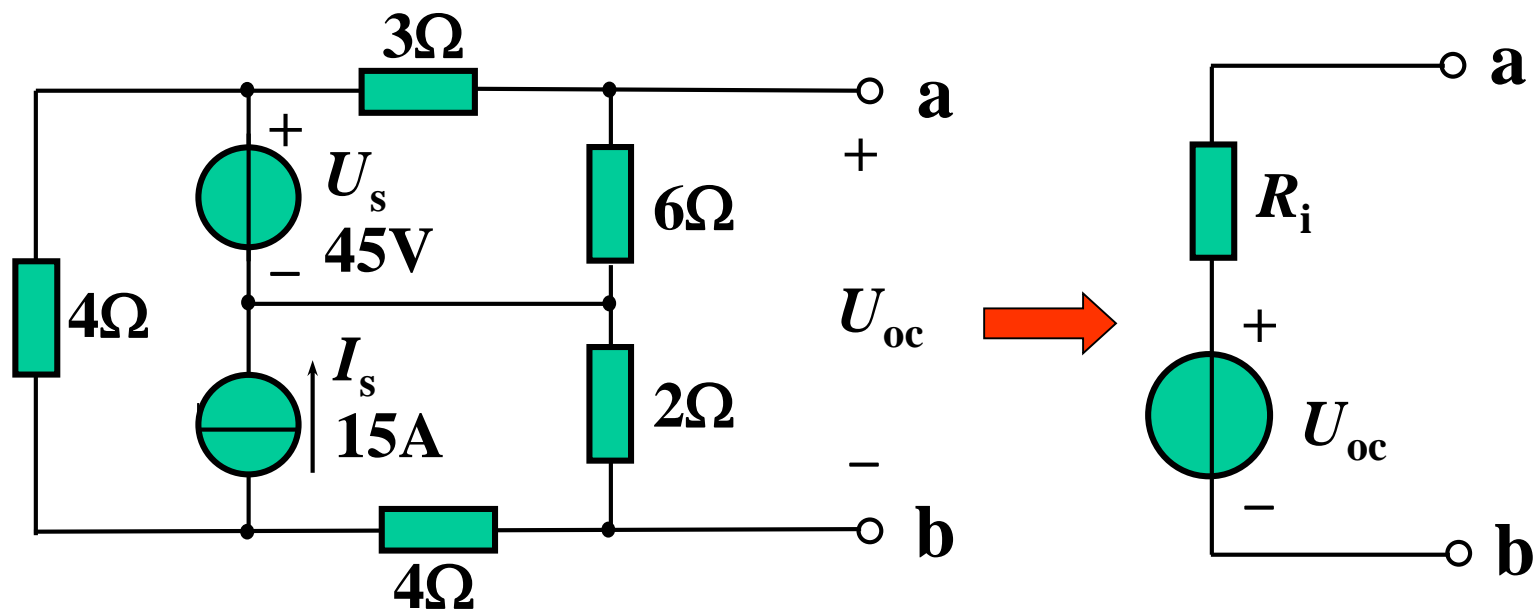


电阻电路习题课 (三)

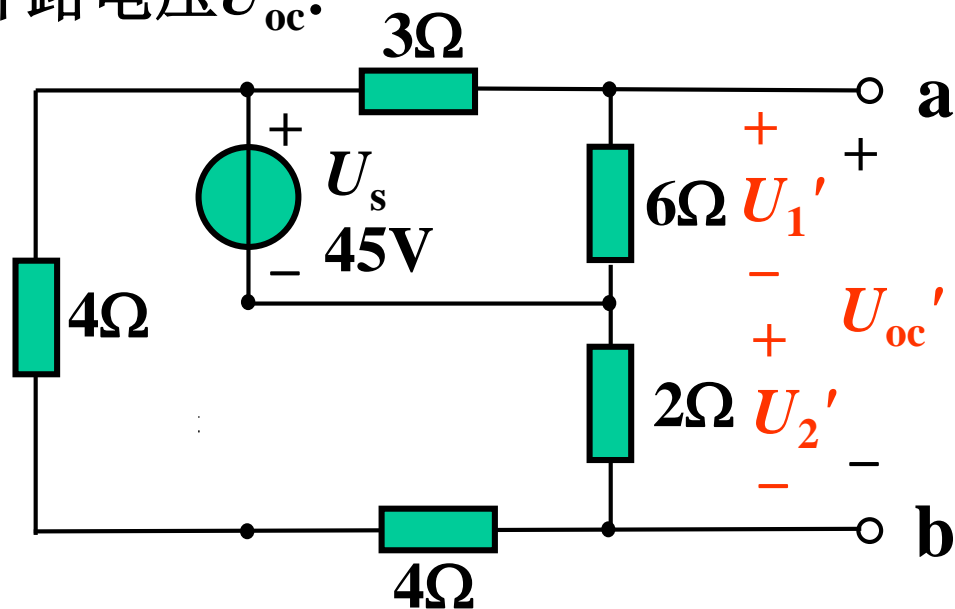
1. 求电流 I 。



解：用戴维南定理：

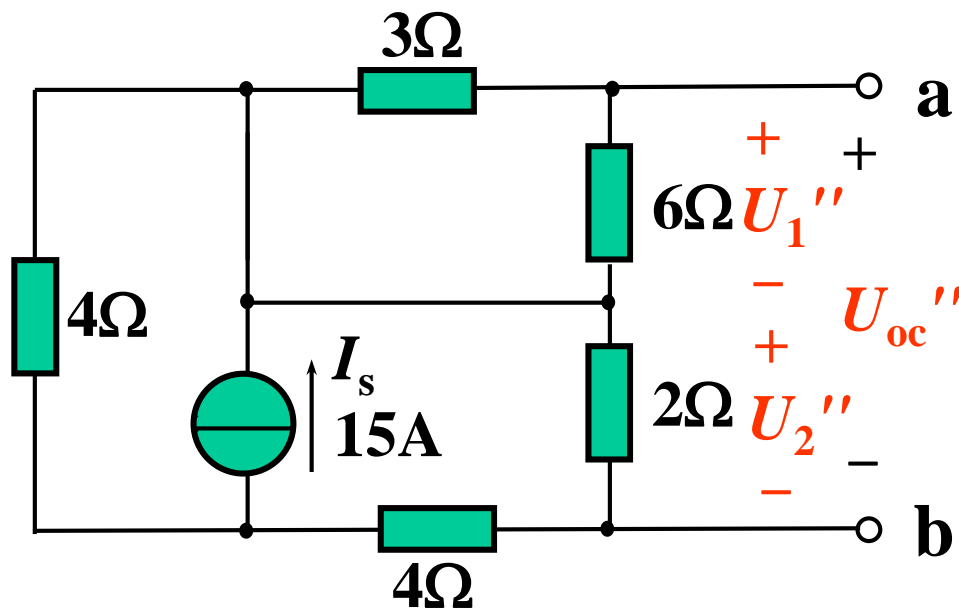


求开路电压 U_{oc} :



$$U_{oc}' = U_1' + U_2'$$

$$= 30 - 9 = 21V$$



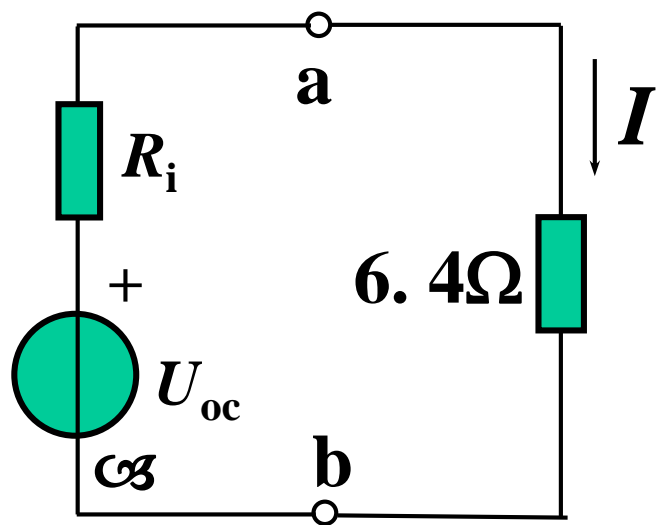
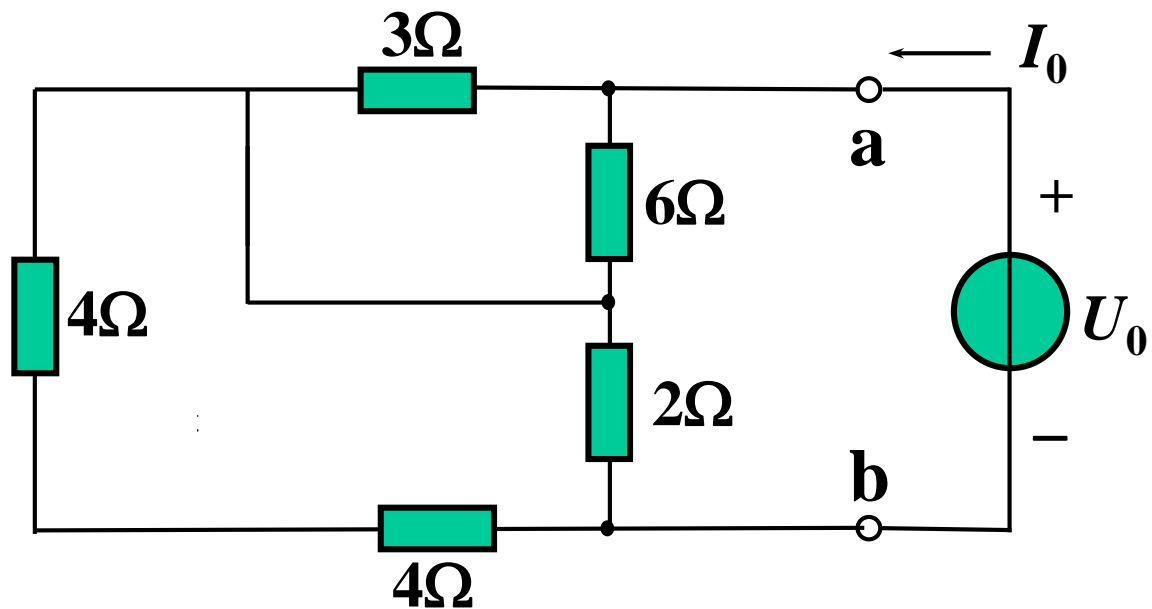
$$U_{oc}'' = U_1'' + U_2''$$

$$= 0 + 12 = 12V$$

$$U_{oc} = U_{oc}' + U_{oc}''$$

$$= 21 + 12 = 33V$$

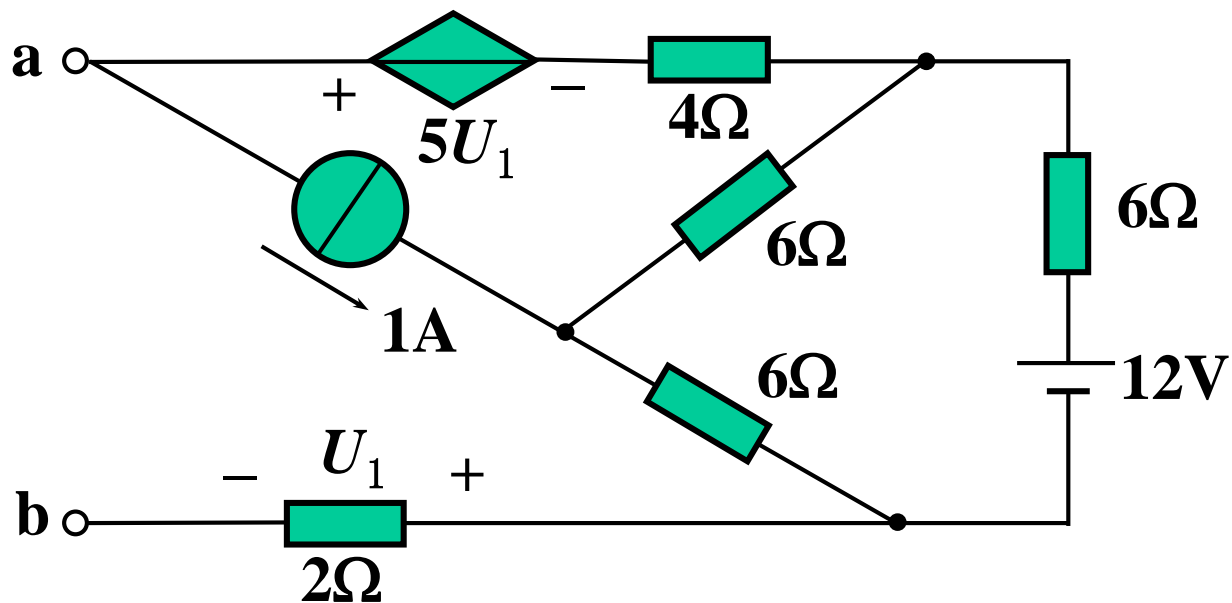
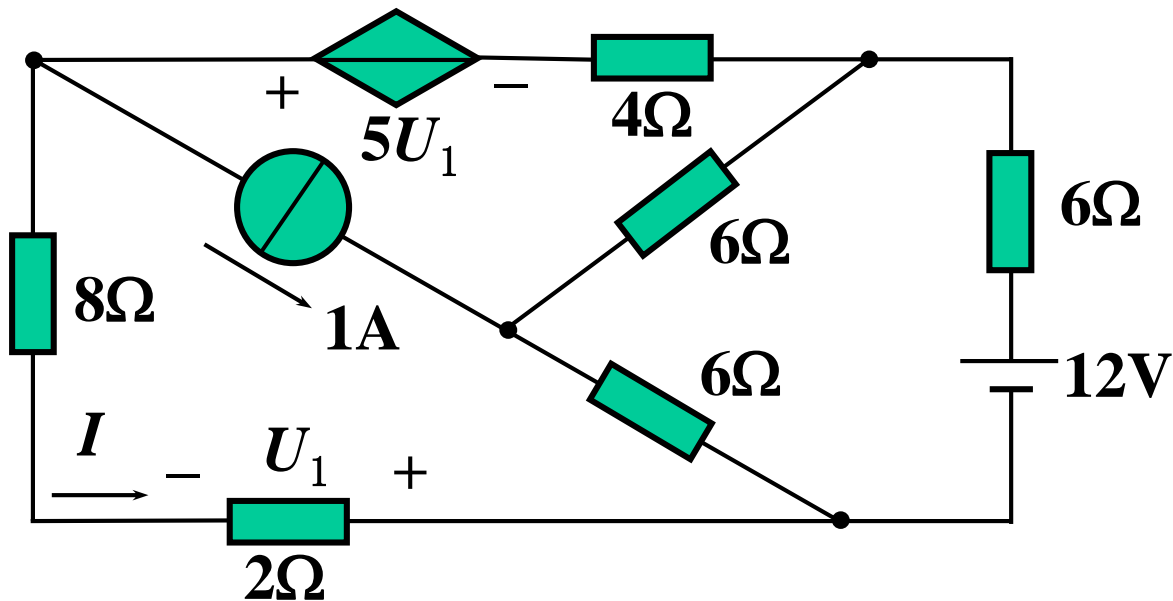
求内阻 R_i ：



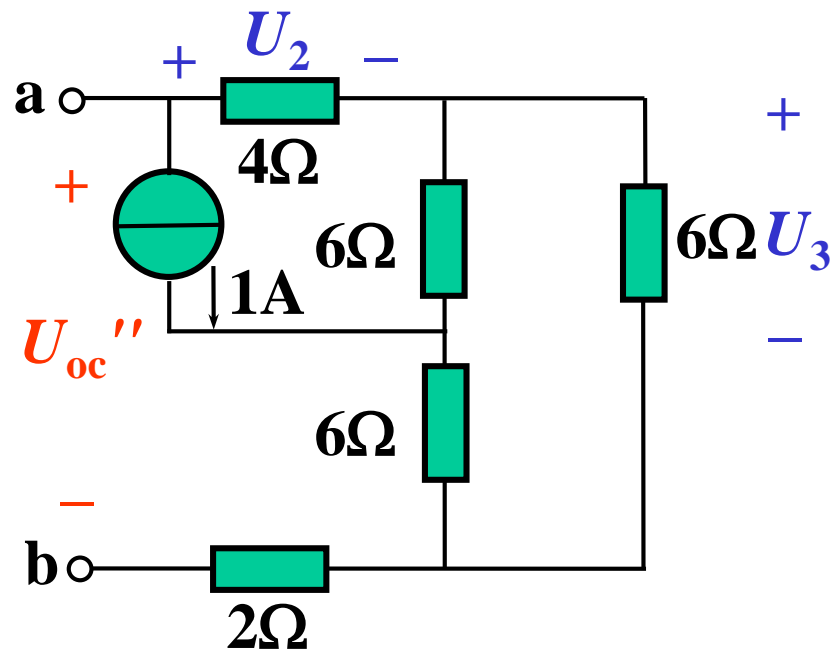
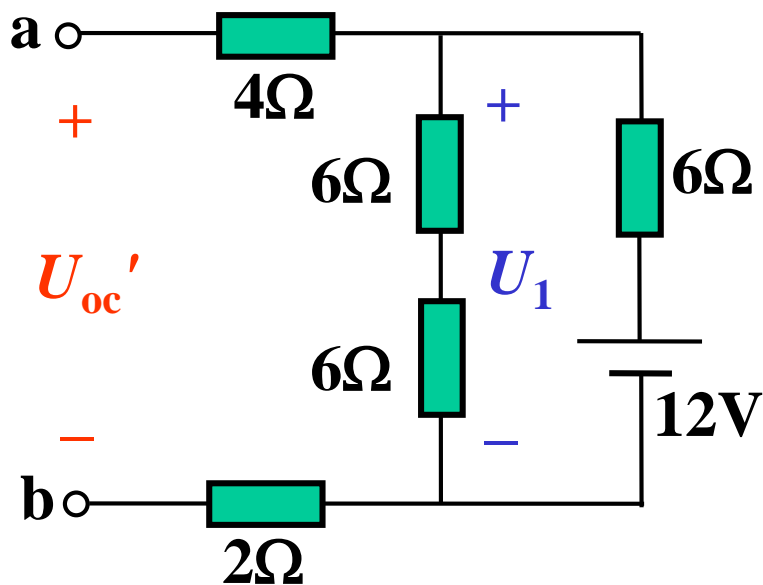
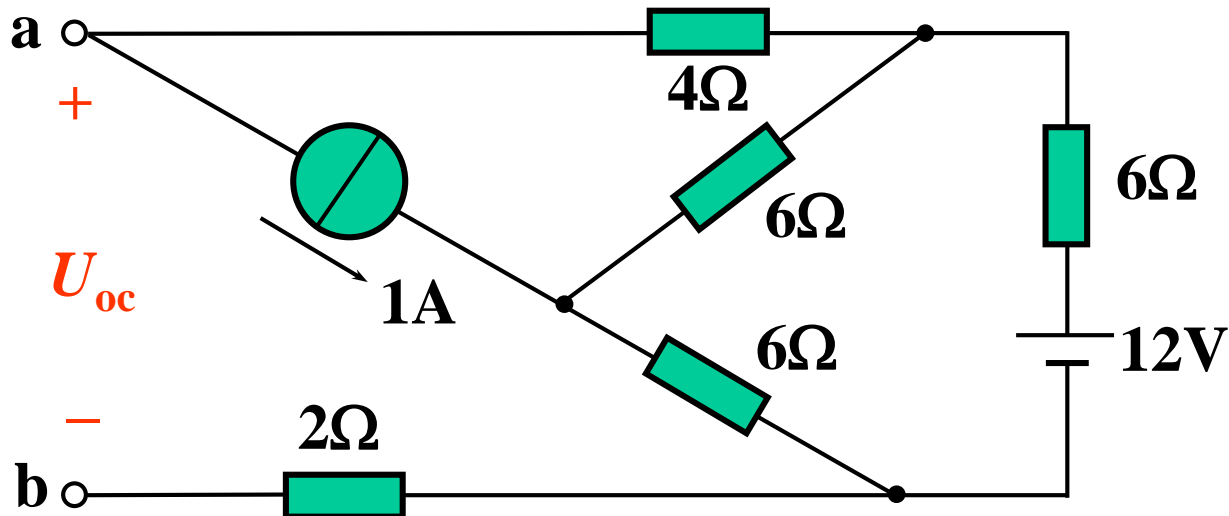
$$R_i = 2 + 1.6 = 3.6\Omega$$

$$I = 33 / (3.6 + 6.4) = 3.3\text{A}$$

2. 用戴维南定理求 I 。

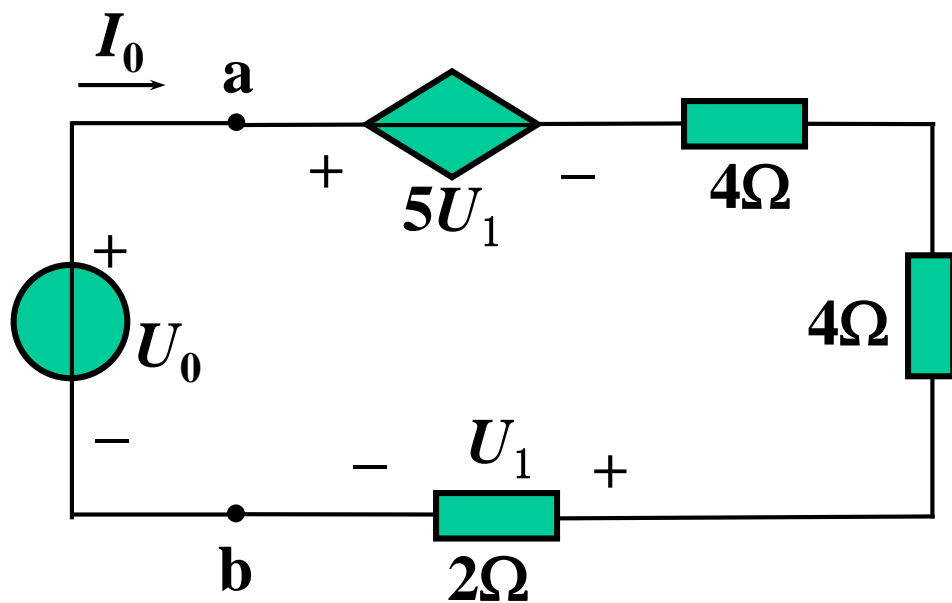
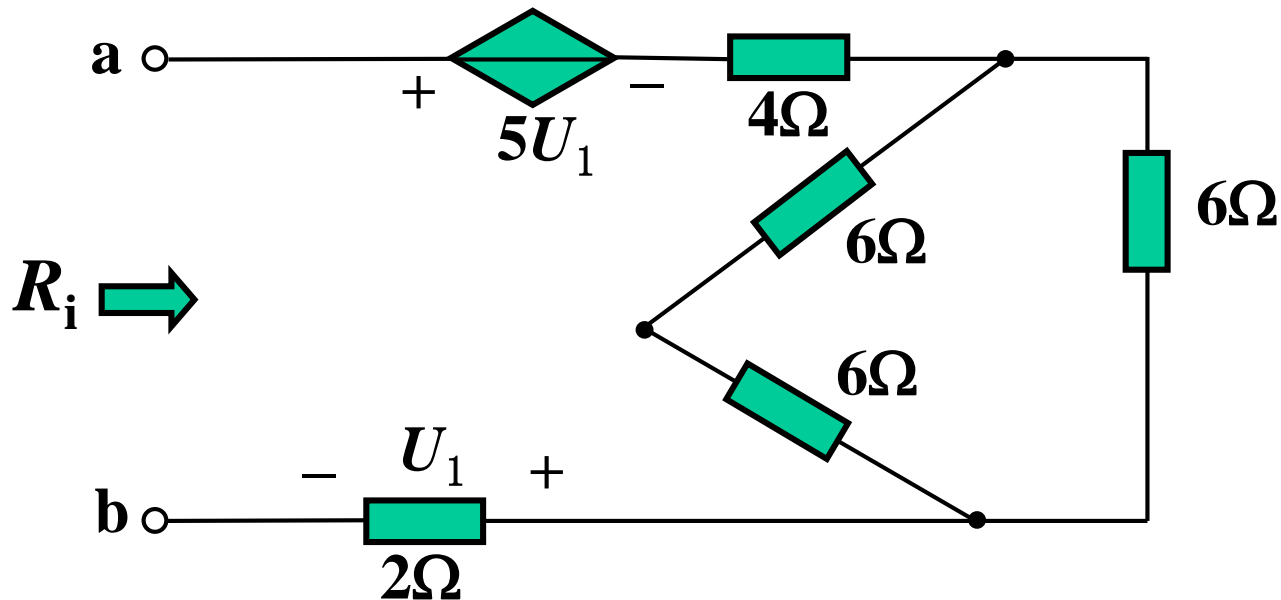


(a) 求开路电压 U_{oc}



$$U_{oc}' = U_1 = 8V, \quad U_{oc}'' = U_2 + U_3 = -4 - 2 = -6V, \quad U_{oc} = 8 - 6 = 2V$$

(b) 求内阻 R_i
加压求流

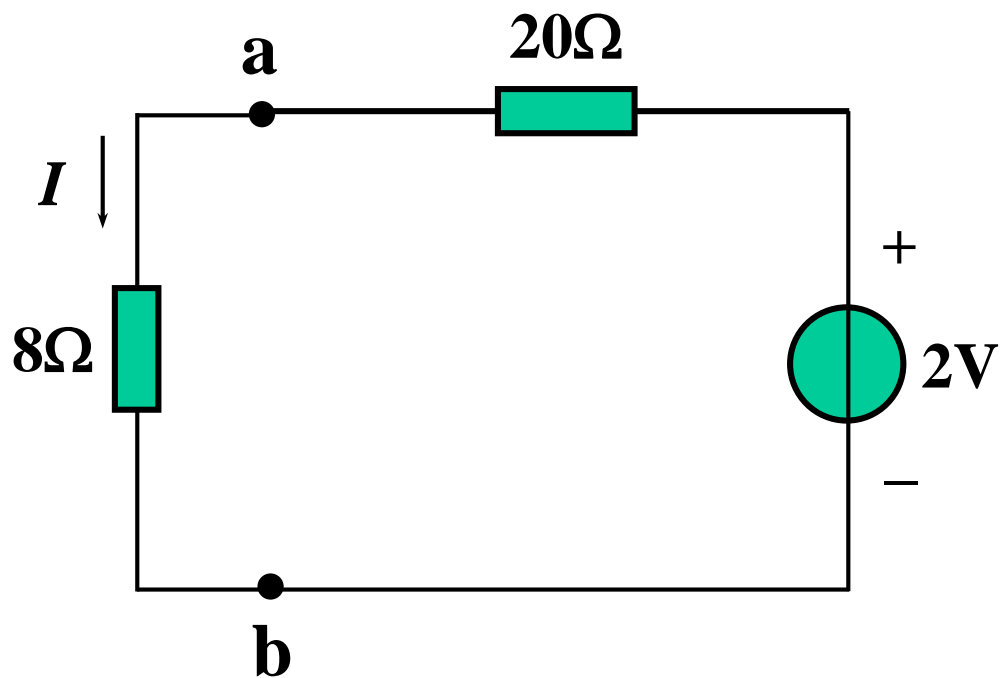


$$5U_1 + 8I_0 + U_1 = U_0$$

$$U_1 = 2I_0$$

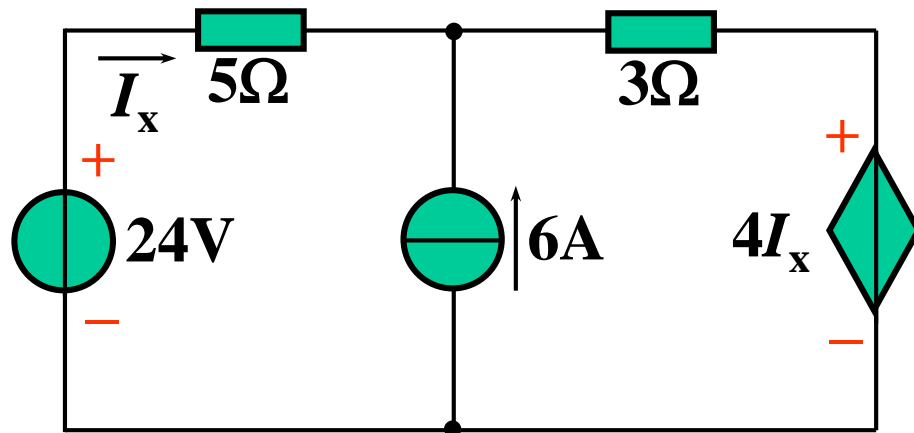
$$R_i = U_0 / I_0 = 20\Omega$$

(c) 戴维南等效电路如图所示：

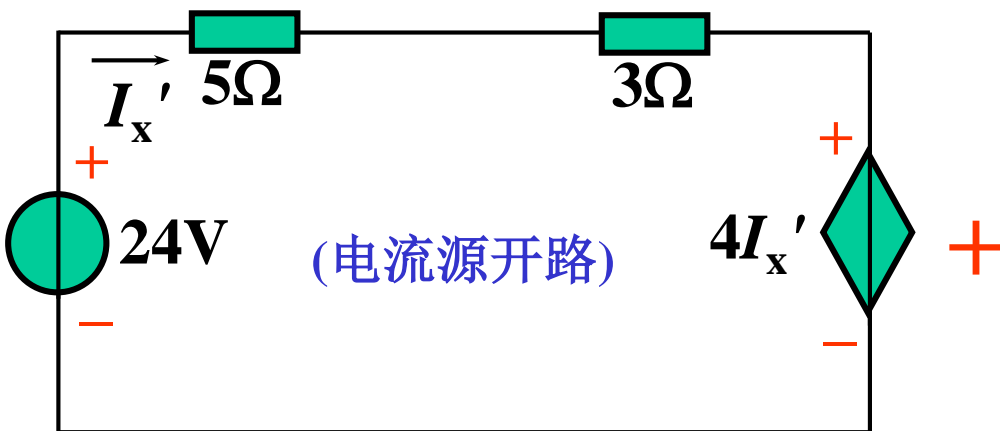


$$I = 2 / (20 + 8) = 1 / 14 = 0.0714 \text{ A}$$

3. 求 I_x .

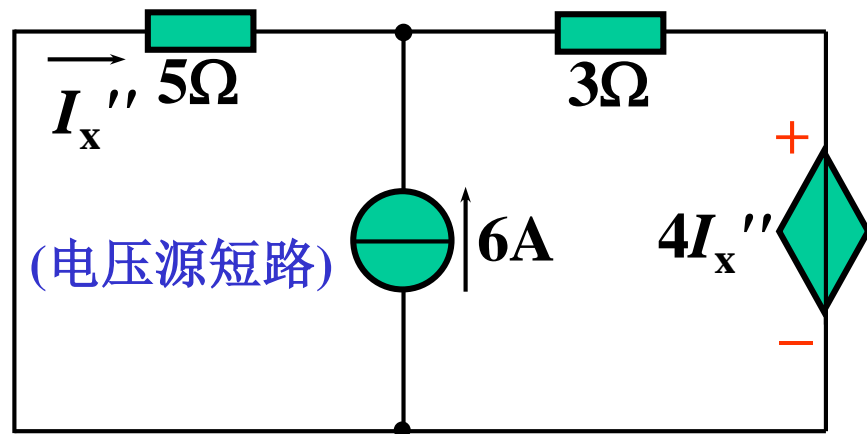


解:



24V电压源单独作用

$$5I_x' + 3I_x' + 4I_x' = 24 \rightarrow I_x' = 2A$$



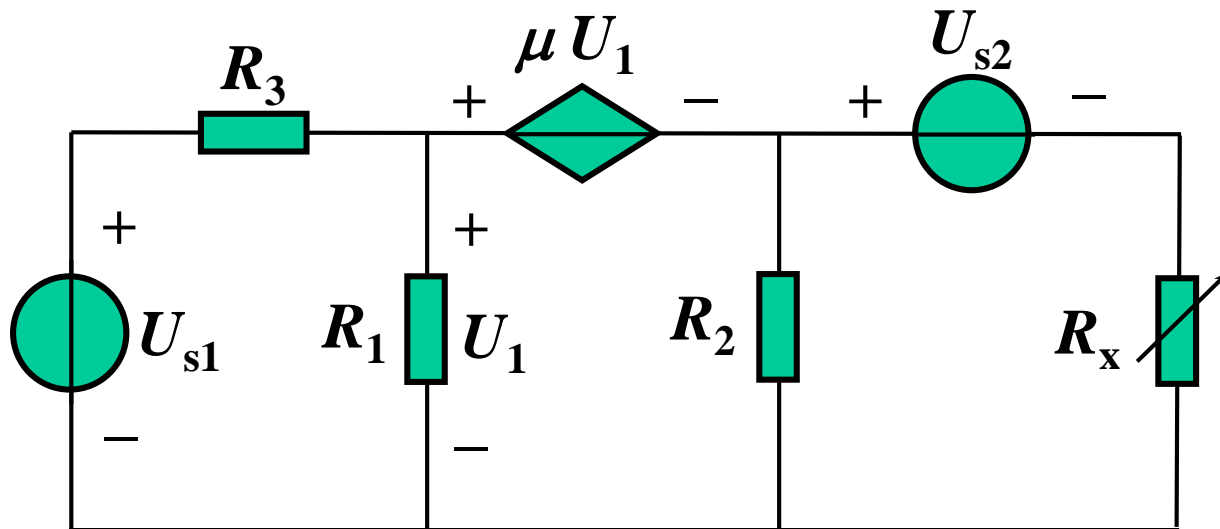
6A电流源单独作用

$$5I_x'' + 3(I_x'' + 6) + 4I_x'' = 0 \rightarrow I_x'' = -1.5A$$

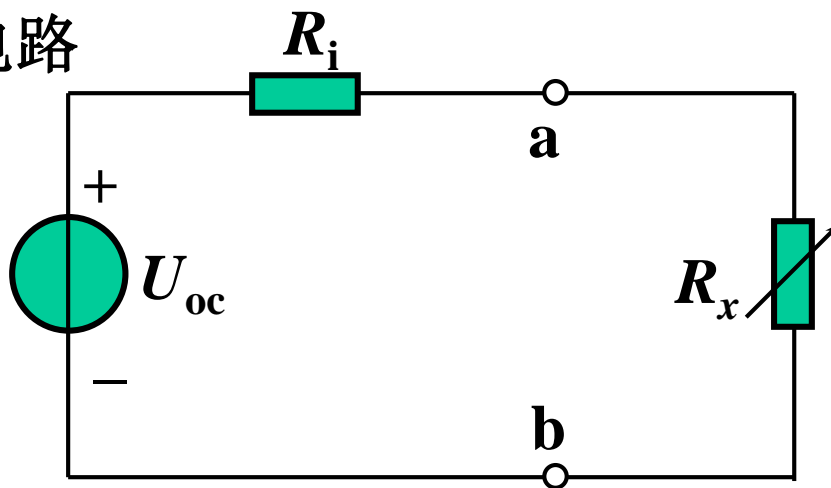
$$I_x = I_x' + I_x'' = 2 - 1.5 = 0.5A$$

* 注意:独立源可以进行叠加, 受控源不叠加。

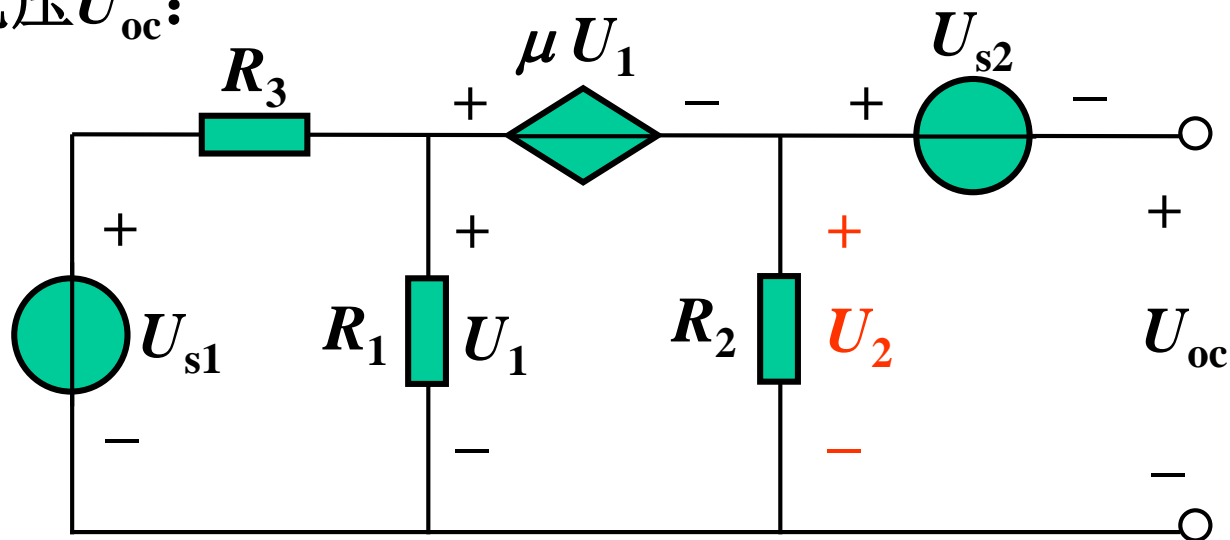
5. 已知 $U_{s1} = 100\text{V}$, $U_{s2} = 120\text{V}$, $R_1 = R_2 = 10\Omega$, $R_3 = 20\Omega$, $\mu = 0.5$,
试问： R_x 为何值时其上可获得最大功率？并求此最大功率 P_{\max} 。



解：用戴维南等效电路



求开路电压 U_{oc} :

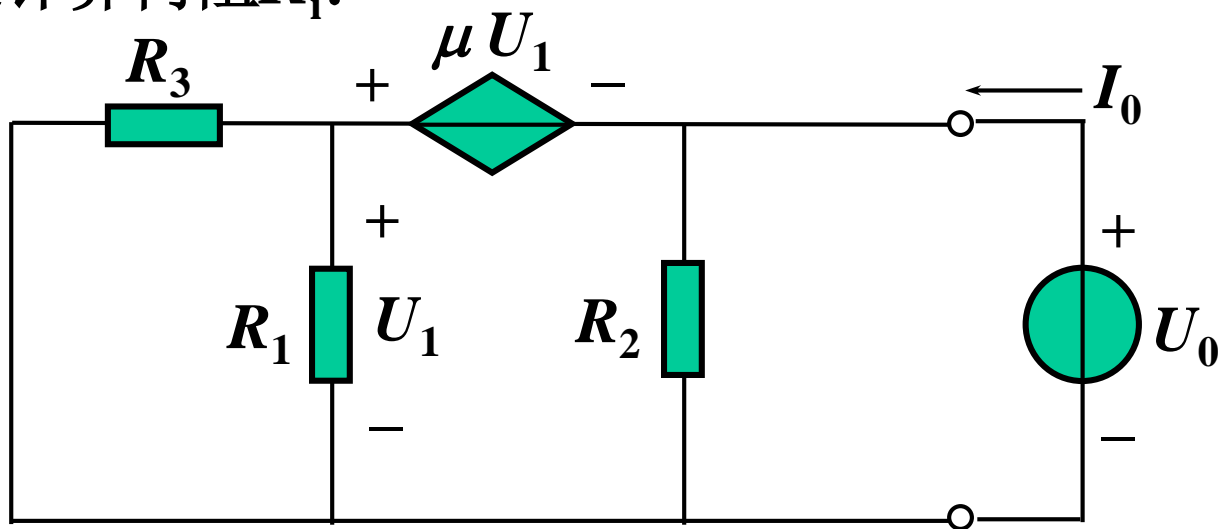


$$U_{oc} = -U_{s2} + U_2$$

$$\begin{cases} U_{s1} = \left(\frac{(1-\mu)U_1}{R_2} + \frac{U_1}{R_1} \right) R_3 + U_1 \\ U_2 = (1-\mu)U_1 \end{cases} \Rightarrow \begin{cases} U_1 = 25V \\ U_2 = 12.5V \end{cases}$$

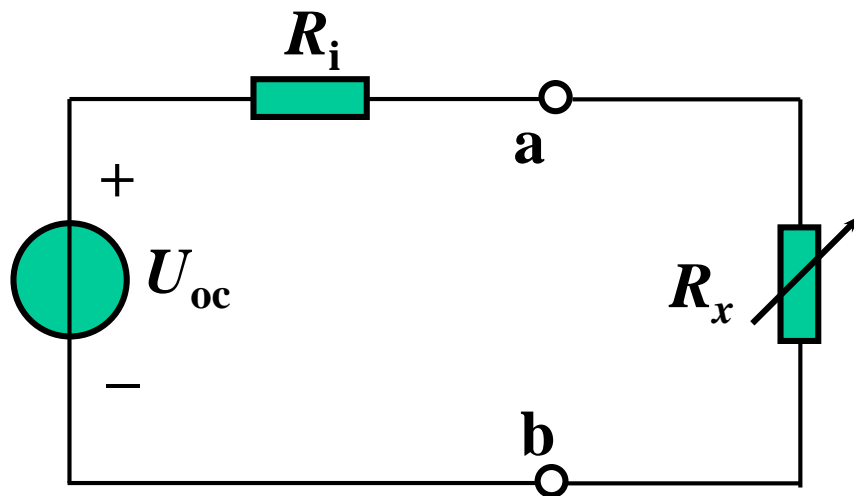
$$U_{oc} = -U_{s2} + U_2 = -120 + 12.5 = -107.5V$$

加压求流计算内阻 R_i :



$$\begin{cases} I_0 = \frac{U_0}{R_2} + \frac{U_1}{R_3 // R_1} \\ U_0 = -\mu U_1 + U_1 \end{cases} \Rightarrow I_0 = \frac{U_0}{R_2} + \frac{U_0 / (1 - \mu)}{R_3 // R_1}$$

$$\begin{aligned} \text{则 } R_i &= \frac{U_0}{I_0} = 1 / \left(\frac{1}{R_2} + \frac{1 / (1 - \mu)}{R_3 // R_1} \right) \\ &= 1 / \left(\frac{1}{10} + \frac{1 / (1 - 0.5)}{10 \times 20 / (10 + 20)} \right) = 2.5 \, \Omega \end{aligned}$$

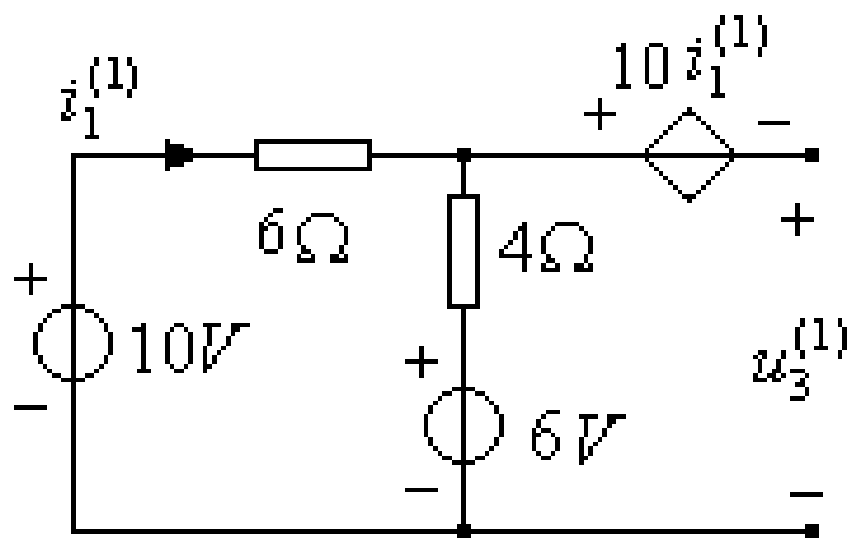
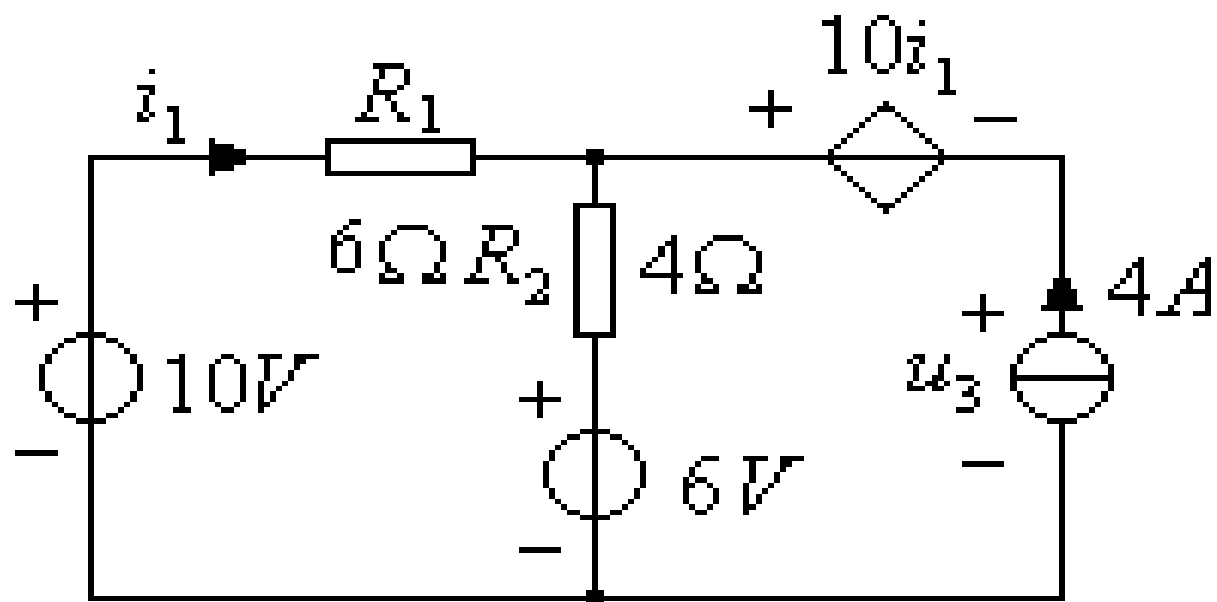


$R_x = R_i = 2.5\Omega$ 时 R_x 上获得最大功率。

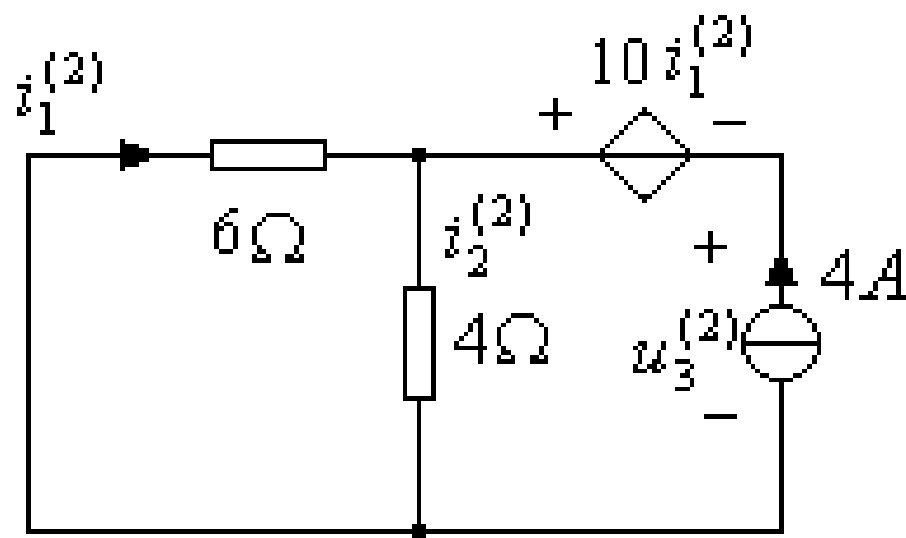
此时最大功率为

$$P_{\max} = \frac{U_{oc}^2}{4R_i} = \frac{107.5^2}{4 \times 2.5} = 1155.6\text{W}$$

7. 电路如下图所示，
试求电压 u_3 。

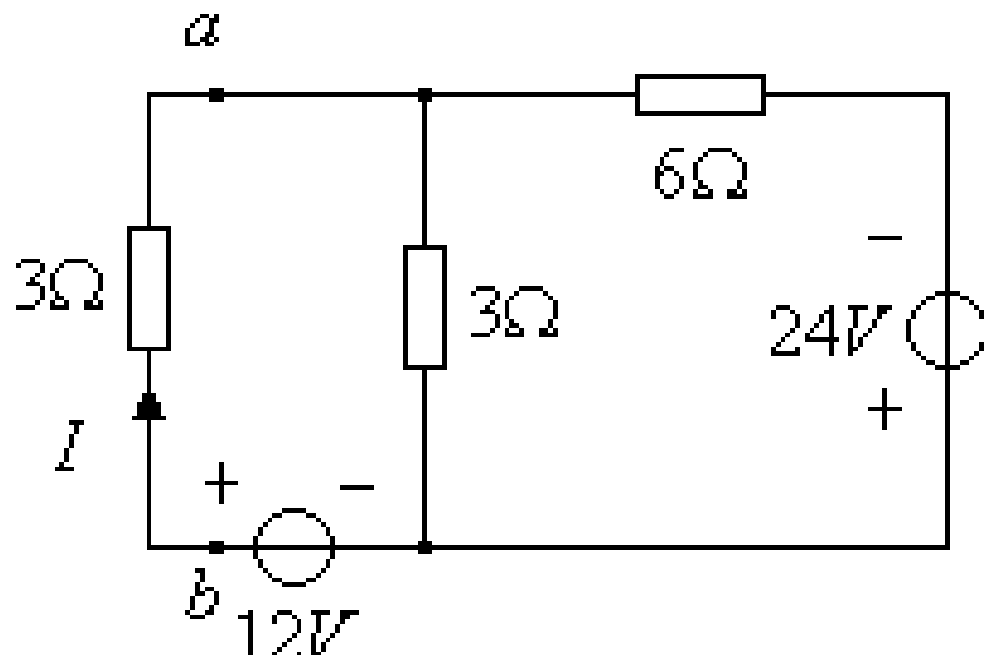


$10V, 6V$ 共同作用

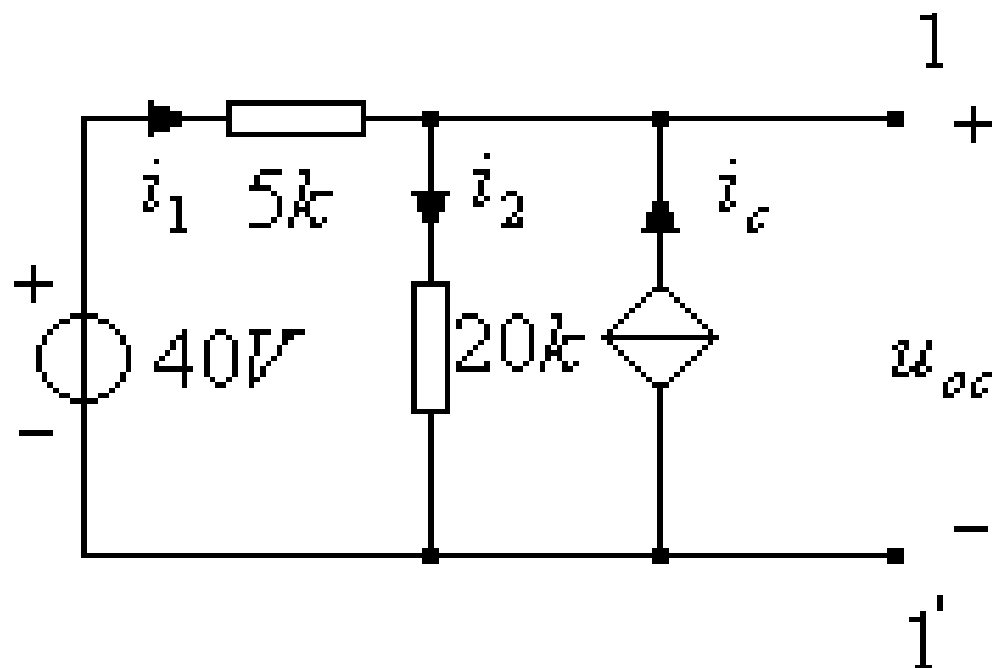


$4A$ 单独作用

8. 用诺顿定理求下图所示电路中 3Ω 电阻的电流 I 。



9. 求下图所示电路的戴维南等效电路和诺顿等效电路，一端口内部有电流控制电流源， $i_c = 0.75 i_1$ 。



10. 求下图中 R 为何值时能从电路中获得最大功率?

