

华东交通大学 2012—2013 学年第二学期考试卷

试卷编号: _____ (A) 卷

电路原理 I 课程 课程类别: 必

闭卷

考试日期: _____

2012 级电气工程、自动化、电子信息、建筑电气、交通设备信息工程专业适用

题号	一	二	三	四	五	六	七	八	九	十	总分	累分人 签名
题分	30	10	12	14	10	14	10				100	
得分												

考生注意事项: 1、本试卷共 6 页, 总分 100 分, 考试时间 120 分钟。

2、考试结束后, 考生不得将试卷、答题纸和草稿纸带出考场。

得分	评阅人

一、计算题(每题 5 分, 共 30 分)

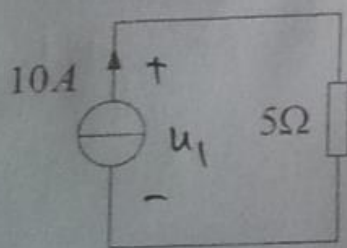
1. 已知 R 阻值为 5000Ω , 功率为 $0.5W$, 在使用时所能施加的电压和所能通过的电流最大各为多少。

$$P = Ri^2 = \frac{U^2}{R}$$

$$i = \sqrt{\frac{P}{R}} = \sqrt{\frac{0.5}{5000}} = 0.01A$$

$$U = \sqrt{PR} = \sqrt{5000 \times 0.5} = 50V$$

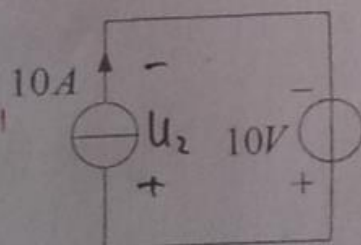
2. 一个 $10A$ 的电流源, 分别接一个 5Ω 的电阻和一个 $10V$ 的电压源, 求电流源的电压和功率大小。



(a)

(4) $U_1 = 5 \times 10 = 50V$

$P = 10 \times 50 = 500W$ (发)



(b)

$U_2 = 10V$

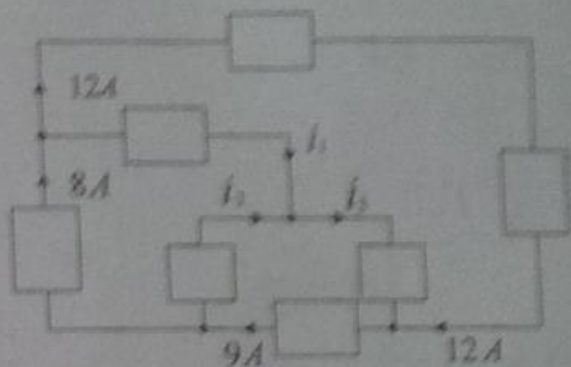
$P = 10 \times 10 = 100W$ (吸收)

3. 求电路中的未知电流大小。

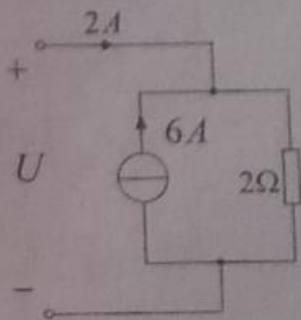
$$i_1 = 8 - 12 = -4 \text{ A}$$

$$i_2 = 9 - 8 = 1 \text{ A}$$

$$i_3 = i_1 + i_2 = -3 \text{ A}$$

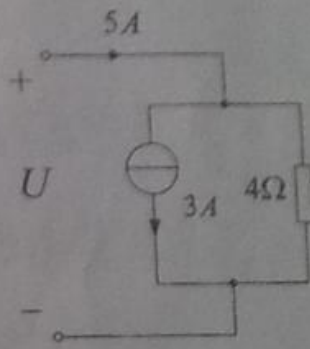


4. 求各电路的电压 U 。



(a)

$$U = (2 + 6) \times 2 = 16 \text{ V}$$



(b)

$$U = (5 - 3) \times 4 = 8 \text{ V}$$

5. 求等效电阻

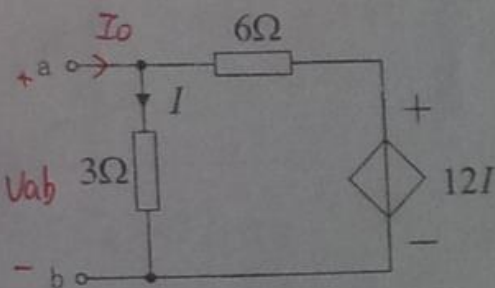
$$U_{ab} = 3I$$

$$U_{ab} = 6(I_0 - I) + 12I$$

$$= 6I_0 + 6I$$

$$-U_{ab} = 6I_0$$

$$R_{eq} = \frac{U_{ab}}{I_0} = -6 \Omega$$

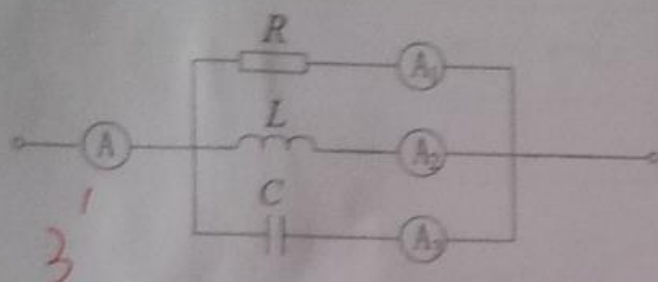


6. 已知图中电流表读数分别为 $A_1: 5A$; $A_2: 20A$; $A_3: 25A$ 。求图中电流表 A 的读数。

$$\dot{I}_1 = 5 \angle 0^\circ A$$

$$\dot{I}_2 = 20 \angle -90^\circ A$$

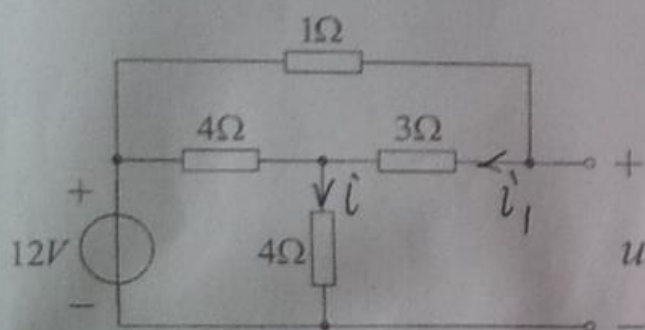
$$\dot{I}_3 = 25 \angle 90^\circ A$$



$$\dot{I} = \dot{I}_1 + \dot{I}_2 + \dot{I}_3 = 5 + j5 = 5\sqrt{2} \angle 45^\circ A$$

$$\therefore I = 5\sqrt{2} = 7.07 A$$

二、电路如图所示，求电压 u 。(10分)



得分	评阅人

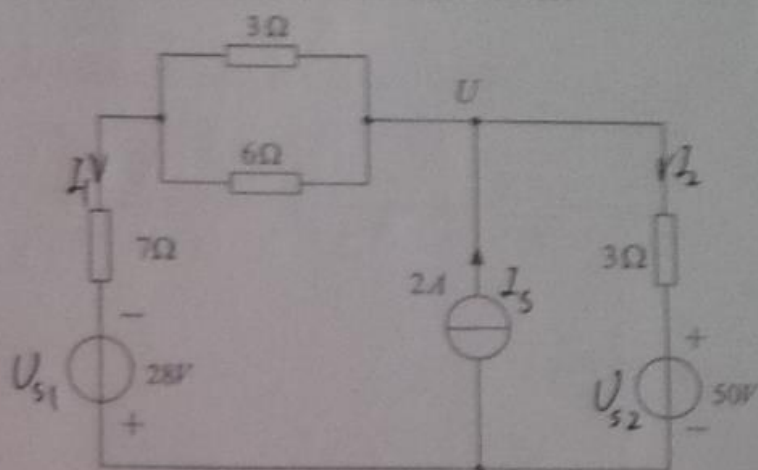
$$\text{解：由欧姆定律得 } i = \frac{12}{(1+3)/4 + 4} = 2 A$$

$$\text{由分流公式得 } i_1 = \frac{4}{(1+3)+4} \times i = 1 A$$

$$\therefore u = 3i_1 + 4i = 3 \times 1 + 4 \times 2 = 11 V$$

或由 $Y-\Delta$ 变换、回路法等方法计算。

三、求图中结点电压 U ，并验证功率平衡。(12分)



得分	评阅人

$$U = \frac{-\frac{28}{9} + 2 + \frac{50}{3}}{\frac{1}{3} + \frac{1}{6} + \frac{1}{3}} = 35 \text{ V} \quad (4')$$

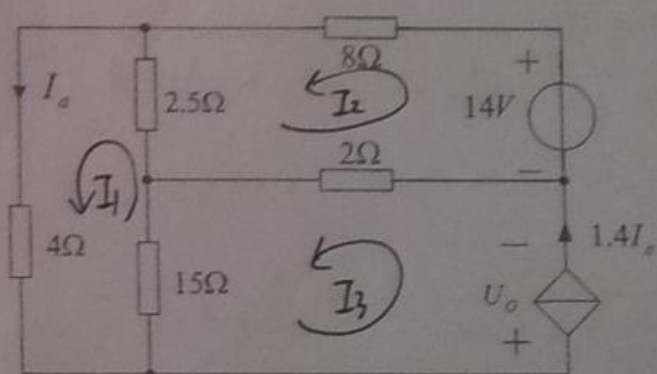
$$I_1 = \frac{U+28}{9} = 7 \text{ A} \quad (1')$$

$$I_2 = \frac{U-50}{3} = -5 \text{ A} \quad (1')$$

电源功率: $P_{U_{s1}} = 28I_1 = 196 \text{ W} \quad (1')$
 $P_{U_{s2}} = 50I_2 = -250 \text{ W} \quad (1')$
 $P_{I_s} = 2U = 70 \text{ W} \quad (1')$

电阻发出功率 $P_R = P_{U_{s1}} - P_{U_{s2}} + P_{I_s} = 516 \text{ W} \quad (1')$
 电阻消耗功率 $P_R = I_1^2(7+3) + I_2^2 \cdot 3 = 516 \text{ W} \quad (2')$
 $\therefore$ 功率平衡

四、用回路电流法求解图中的电流 I_o 和电压 U_o 。(14分)



得分	评阅人

在回路中列KVL方程

$$U_o + 2(I_3 - I_2) + 15(I_3 - I_1) = 0 \quad (2')$$

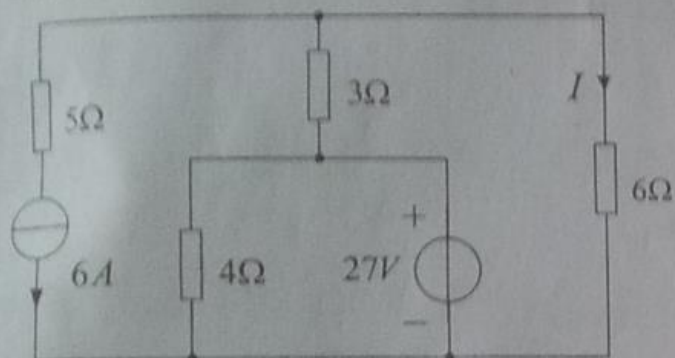
$$\text{或 } U_o = 42 \text{ V} \quad (1')$$

$$\begin{cases} (4+2.5+15)I_1 - 2.5I_2 - 15I_3 = 0 & (3') \\ -2.5I_1 + (2.5+2+8)I_2 - 2I_3 = 14 & (3') \\ I_3 = 1.4I_o & (1') \\ I_o = I_1 & (1') \end{cases}$$

$$\therefore \begin{cases} I_o = -5 \text{ A} \\ U_o = 42 \text{ V} \end{cases}$$

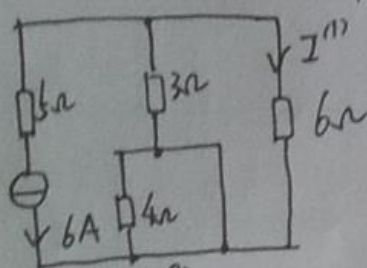
解得: $\begin{cases} I_1 = I_o = -5 \text{ A} \\ I_2 = -1 \text{ A} \\ I_3 = -7 \text{ A} \end{cases} \quad (3')$

五、用叠加定理求解电流 I 。(10 分)

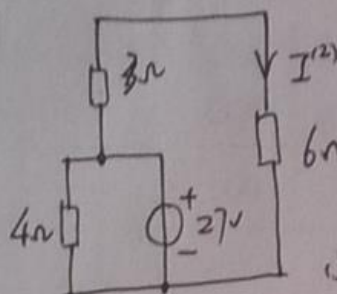


得分	评阅人

解：画出两电源分别单独作用时的分电路 (a)、(b)



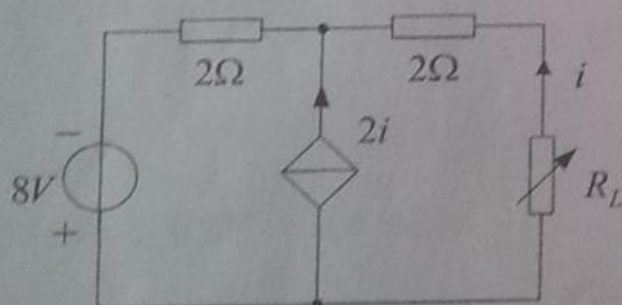
$$I^{(1)} = -\frac{3}{3+6} \times 6 = -2A \quad 2'$$



$$I^{(2)} = \frac{27}{3+6} = 3A \quad 2'$$

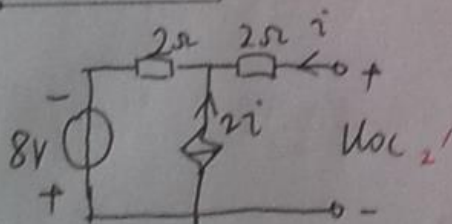
$$\therefore I = I^{(1)} + I^{(2)} = -2 + 3 = 1A \quad 2'$$

六、图中 R_L 可变，试当 R_L 为多大时可获得最大功率，并求此功率。(14 分)



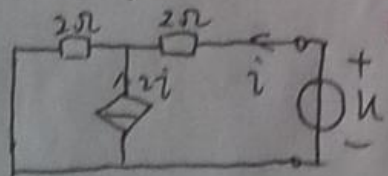
得分	评阅人

解：①求 U_{oc} ：

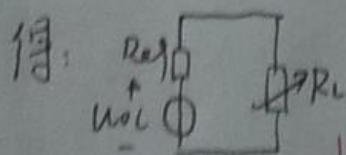


$$i=0 \Rightarrow U_{oc} = -8V \quad 2'$$

②求 R_{eq} ：



$$U = 2i + 2(2i + i) \Rightarrow R_{eq} = \frac{U}{i} = 8\Omega \quad 3'$$



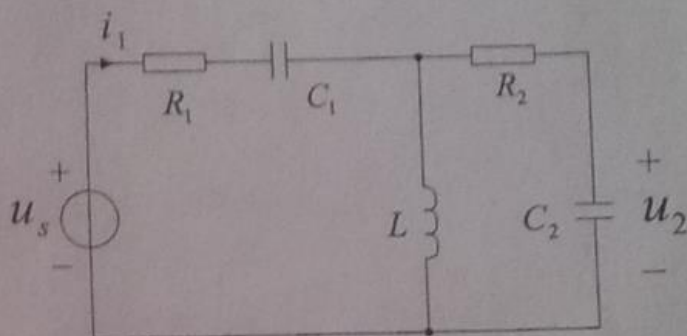
即：当 $R_L = R_{eq} = 8\Omega$ 时，可获得最大功率

$$P_{L_{max}} = \frac{U_{oc}^2}{4R_{eq}} = 2W \quad 2'$$

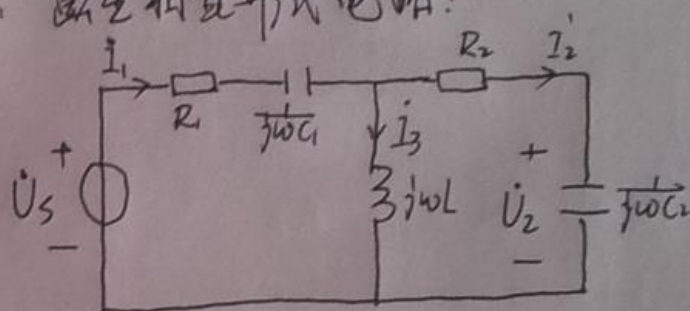
七、已知 $u_s = 10\sqrt{2} \cos(10t) \text{ V}$, $R_1 = R_2 = 1\Omega$, $L = 0.02 \text{ H}$,

得分	评阅人

$C_1 = C_2 = 0.01 \text{ F}$, 求电流 i_1 和电压 u_2 。(10分)



解：画出相量形式电路：



$$\dot{U}_s = 10 \angle 0^\circ$$

$$\dot{I}_1 = \frac{\dot{U}_s}{R_1 + \frac{1}{j\omega C_1} + j\omega L \parallel (R_2 + \frac{1}{j\omega C_2})} = \frac{10 \angle 0^\circ}{1 + \frac{1}{j\omega \times 0.01} + j\omega \times 0.02 \parallel (1 + \frac{1}{j\omega \times 0.01})}$$

$$= 1.02 \angle 84.17^\circ \text{ A}$$

$$\dot{U}_2 = \dot{I}_2 \times \frac{1}{j\omega C_2} = \dot{I}_1 \times \frac{j\omega L}{j\omega L + R_2 + \frac{1}{j\omega C_2}} \times \frac{1}{j\omega C_2} = 1.02 \angle 84.17^\circ \times \frac{j\omega \times 0.02}{j\omega \times 0.02 + 1 + \frac{1}{j\omega \times 0.01}} \times \frac{1}{j\omega \times 0.01}$$

$$= 0.21 \angle 168.34^\circ$$

$$\text{故: } \begin{cases} i_1 = 1.02\sqrt{2} \cos(10t + 84.17^\circ) \text{ A} \\ u_2 = 0.21\sqrt{2} \cos(10t + 168.34^\circ) \text{ V} \end{cases}$$