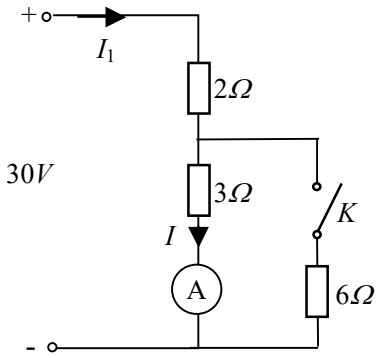
2-1　分别求出题 2-1 图示电路在开关 K 打开和闭合两种情况下的电流表 Ⓐ 的读数。



题 2-1 图

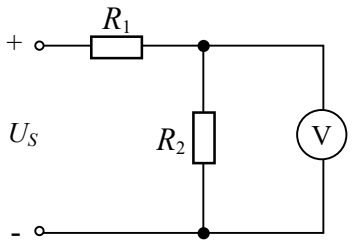
解:打开时:电流表的读数: $I=\dfrac{30}{2+3}=6(A)$

闭合时:　总电阻 $R=2+\dfrac{3\times 6}{3+6}=4\Omega$

$$I_1=\frac{30}{R}=\frac{30}{4}=7.5(A)$$

此时电流表的读数为: $I=\dfrac{6}{3+6}I_1=\dfrac{2}{3}\times 7.5=5(A)$

2-2　题 2-2 图示电路，当电阻 $R_2=\infty$时，电压表 Ⓥ 的读数为 12V；当 $R_2=10\,\Omega$ 时，电压表的读数为 4V，求 R_1 和 U_S 的值。



题 2-2 图

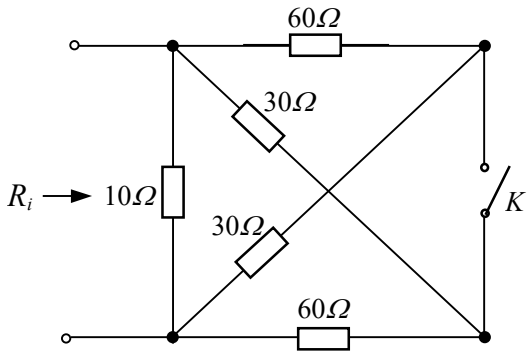
解:当 $R_2=\infty$ 时可知电压表读数即是电源电压 U_S.

$$\therefore U_S=12V.$$

当 $R_2=10\Omega$ 时, 电压表读数: $u=\dfrac{R_2}{R_1+R_2}U_S=\dfrac{10}{R_1+10}\times 12=4$ (V)

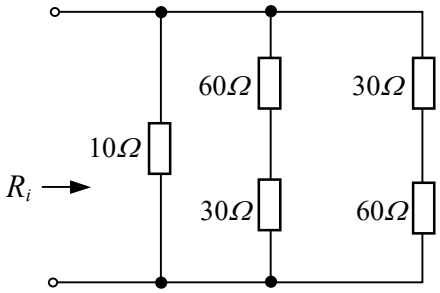
$$\therefore R_1=20\Omega$$

2-3　题 2-3 图示电路。求开关 K 打开和闭合情况下的输入电阻 R_i。



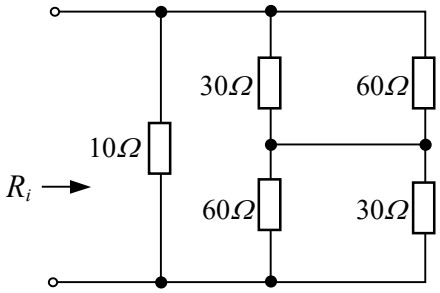
题 2-3 图

解：*K* 打开，电路图为



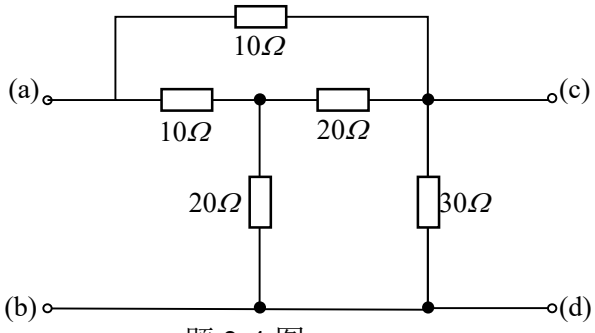
$$\therefore R_i = 10//(60+30)//(60+30) = 10//90//90 = 10//45 = \frac{10\times 45}{10+45} = 8.18(\Omega)$$

K 闭合，电路图为



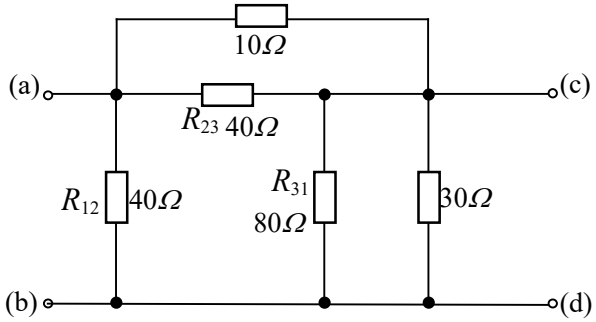
$$\therefore R_i = 10//(30//60+60//30) = 10//2\times\frac{60\times 30}{60+30} = 10//40 = \frac{10\times 40}{10+40} = 8(\Omega)$$

2-4　求题 2-3 图示电路的等效电阻 R_{ab}、R_{cd}。



题 2-4 图

解：电路图可变为：



$$R_{23}=\frac{10\times20+20\times20+10\times20}{20}=\frac{800}{20}=40(\Omega)$$

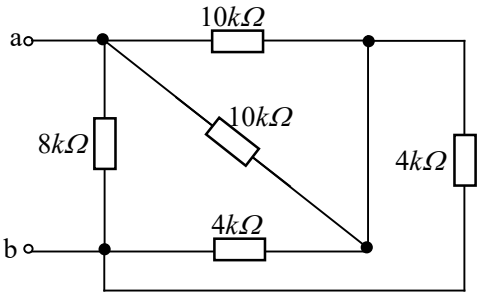
$$R_{31}=\frac{800}{10}=80(\Omega)$$

$$R_{12}=\frac{800}{20}=40(\Omega)$$

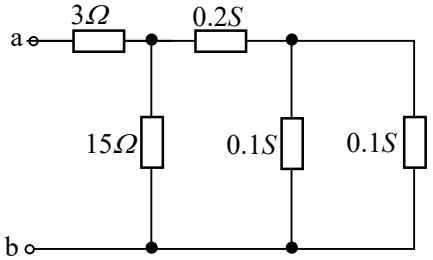
$$R_{ab}=40//(10//40+30//80)=40//29.82=\frac{40\times29.82}{40+29.82}=17.08(\Omega)$$

$$R_{cd}=30//80//(10//40+40)=21.82//48=\frac{21.82\times48}{21.82+48}=15(\Omega)$$

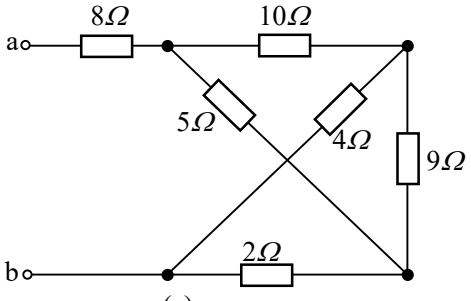
2-5　求题 2-5 图示电路的等效电阻 R_{ab}。



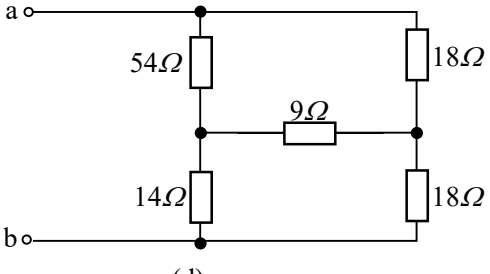
(a)



(b)



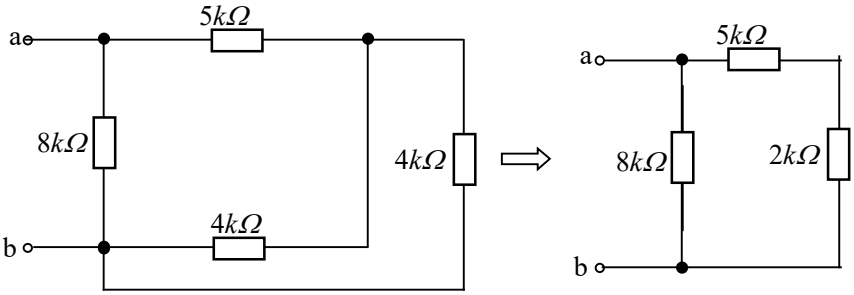
(c)



(d)

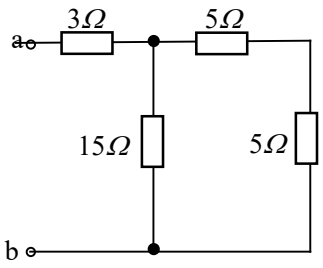
题 2-5 图

解：(a)图等效为：



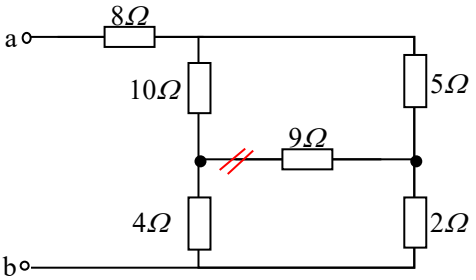
$$\therefore R_{ab}=8//(5+2)=\frac{7\times 8}{7+8}=\frac{56}{15}=3.73(\Omega)$$

(b)图等效为：



$$\therefore R_{ab}=3+15//(5+5)=3+\frac{15\times 10}{15+10}=3+\frac{150}{25}=3+6=9(\Omega)$$

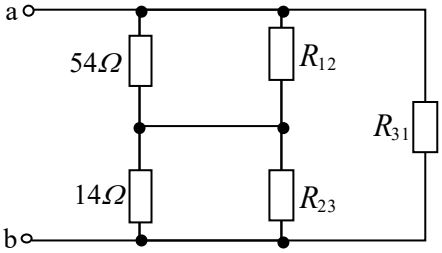
(c)图等效为：



注意到$10\times 2=4\times 5$，电桥平衡，故电路中 9Ω电阻可断去

$$\therefore R_{ab}=8+(10+4)//(5+2)=8+\frac{14\times 7}{14+7}=12.67(\Omega)$$

(d)图等效为：



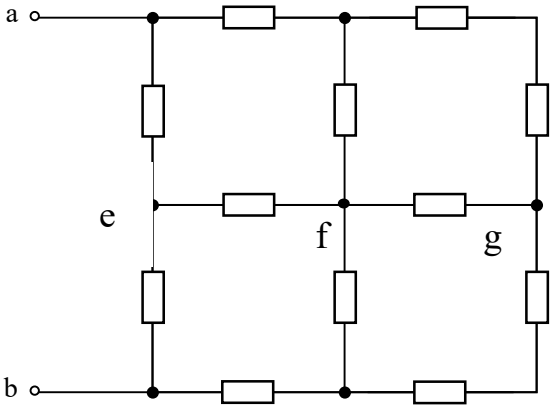
$$R_{12}=\frac{9\times 18+18\times 8+9\times 18}{18}=\frac{648}{18}=36(\Omega)$$

$$R_{23} = R_{12} = 36(\Omega)$$

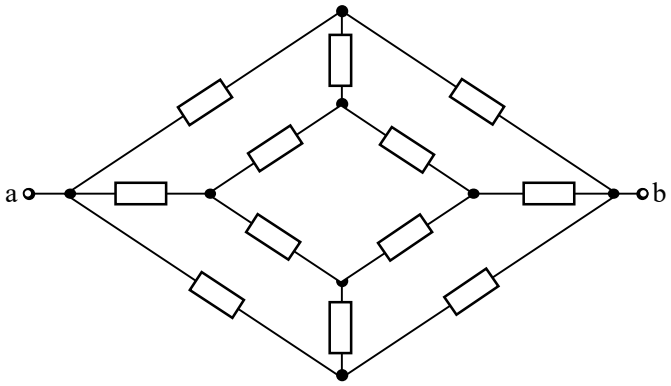
$$R_{31} = 2R_{12} = 72(\Omega)$$

$$R_{ab} = (54 // 36 + 14 // 36) // 72 = 22(\Omega)$$

2-6　题 2-6 图示电路中各电阻的阻值相等，均为 R，求等效 R_{ab}.



(a)

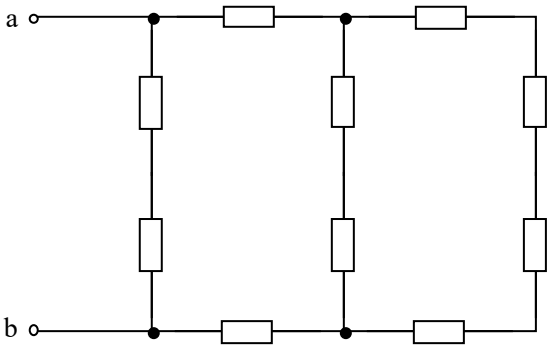


(b)

题 2-6 图

解：e、f、g　为等电位点,所以

(a) 图等效为：

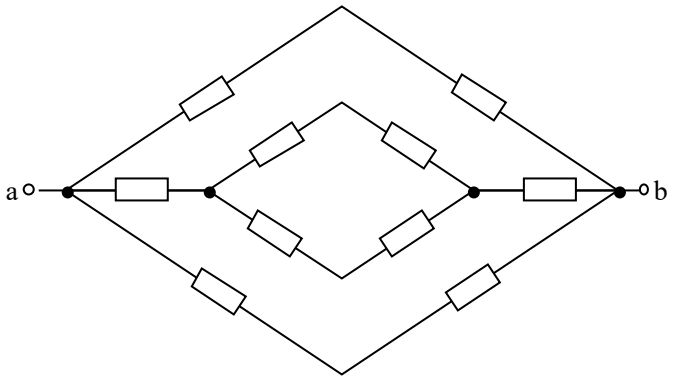


$$R_{ab} = (R + R) // [R + R + (R + R) // (R + R + R + R)]$$

$$= 2R // [2R + 2R // 4R]$$

$$= 2R // \frac{10}{3}R = \frac{5}{4}R$$

(b) 图等效为：

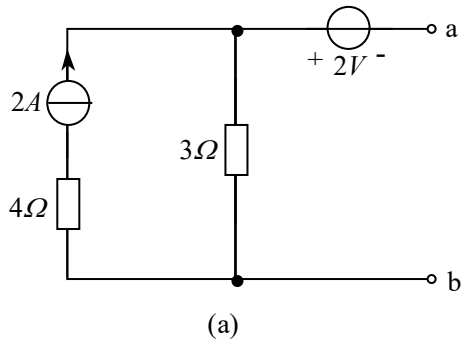


$$R_{ab} = (R+R)//(R+R)//[R+(R+R)//(R+R)+R]$$

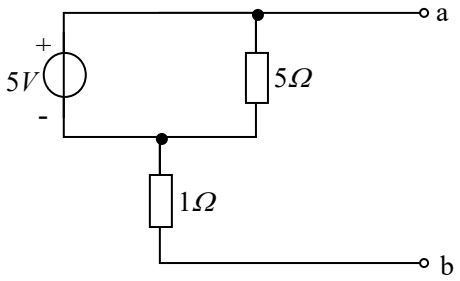
$$= 2R//2R//(2R+2R//2R)$$

$$= R//3R = \frac{3R^2}{4R} = 0.75R$$

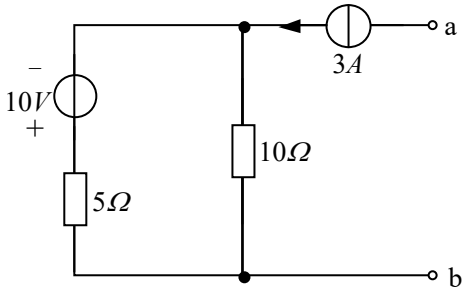
2-7　化简题 2-7 图示各电路.



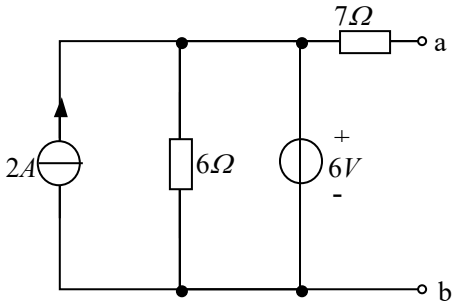
(a)



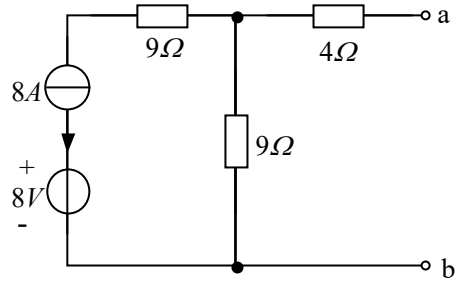
(b)



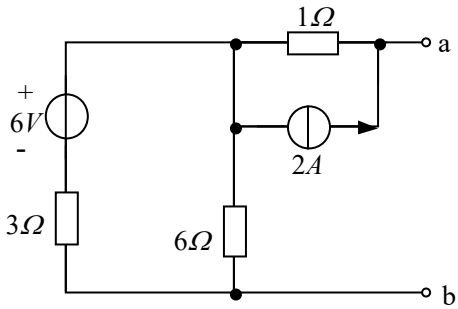
(c)



(d)



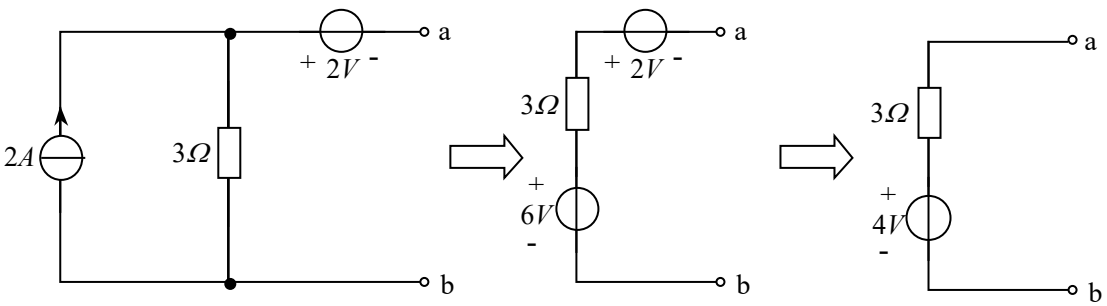
(e)



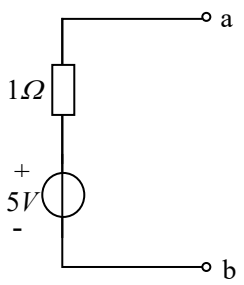
(f)

解：　（注：与电流源串联的元件略去，与电压源并联的元件略去）

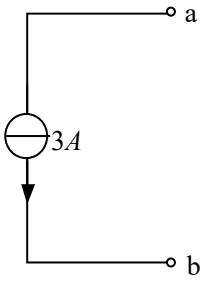
(a)图等效为：



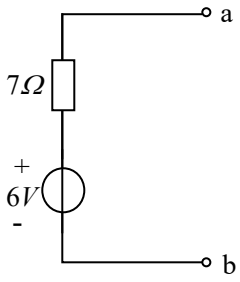
(b)图等效为：



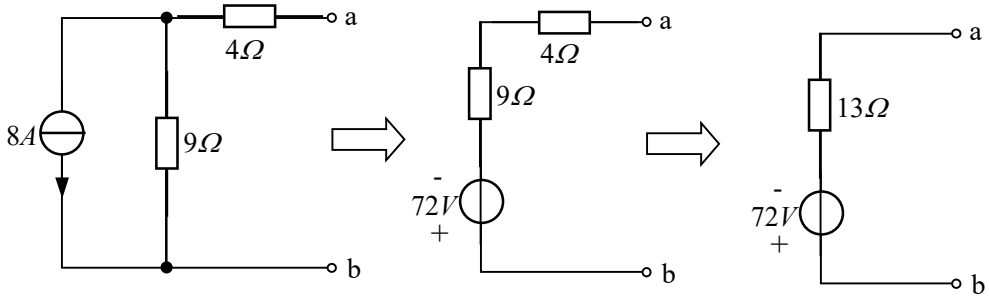
(c)图等效为：



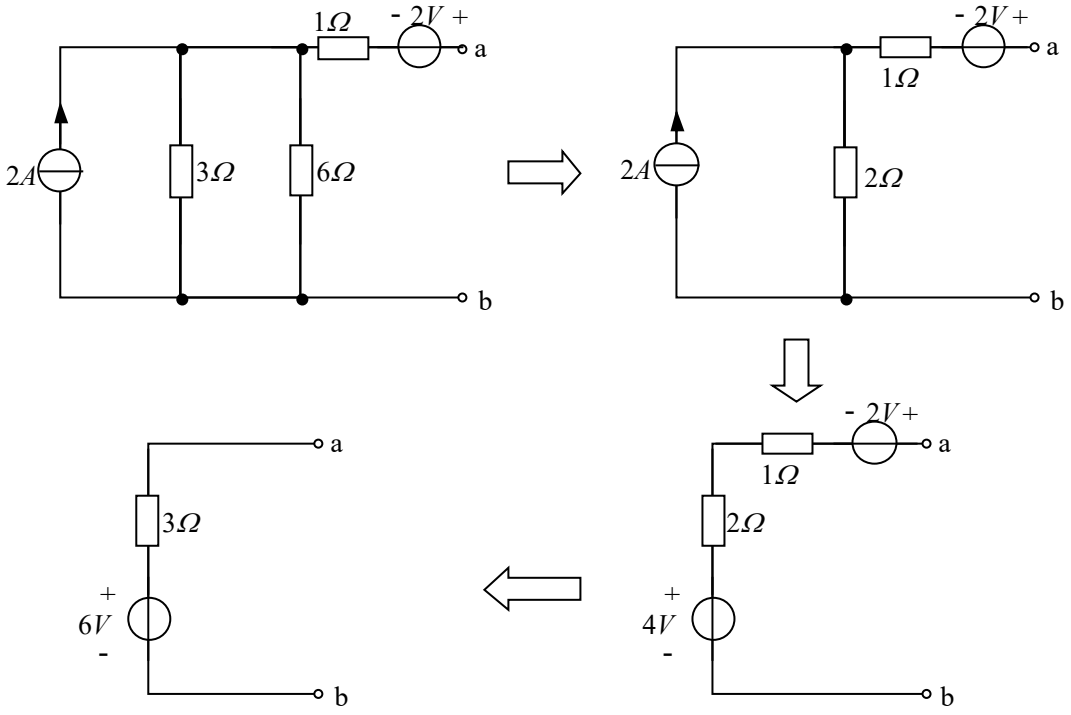
(d)图等效为：



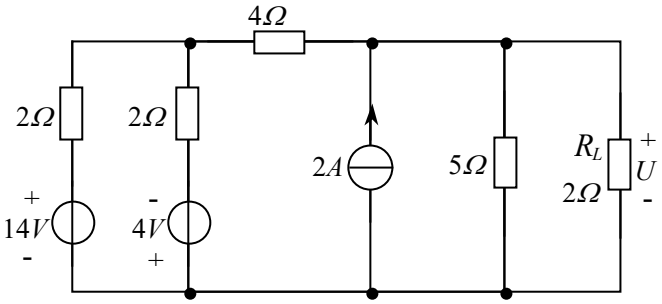
(e)图等效为：



(f)图等效为：

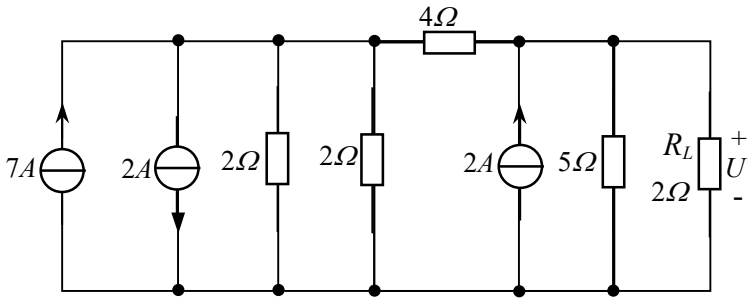


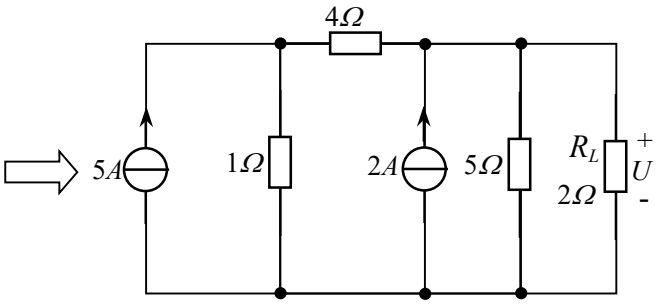
2-8　用电源等效变换法求题 2-8 图示电路中负载 R_L 上的电压 U.

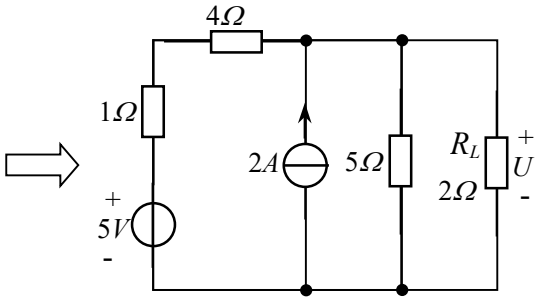


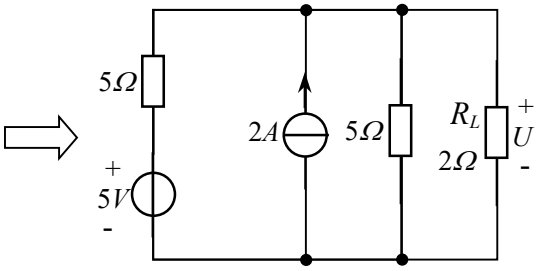
题 2-8 图

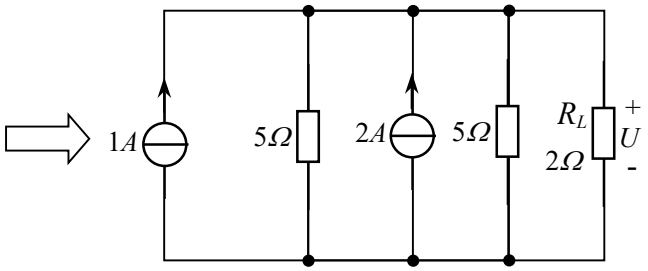
解：电路等效为：

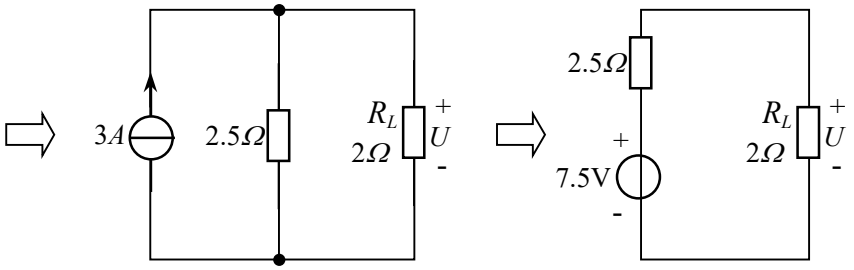






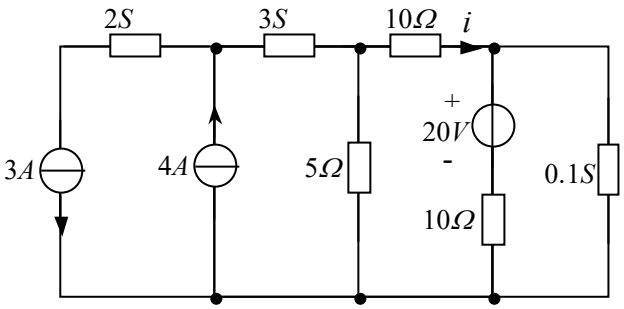






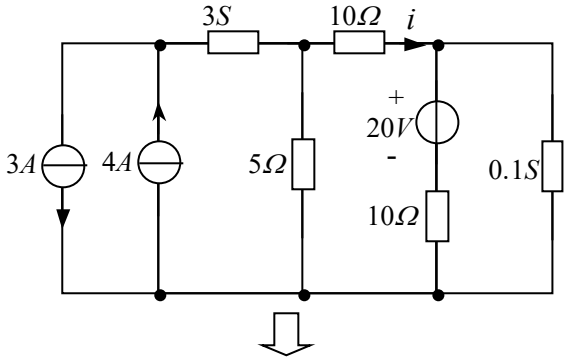
$$U=\frac{2}{2.5+2}\times 7.5=\frac{10}{3}(V)$$

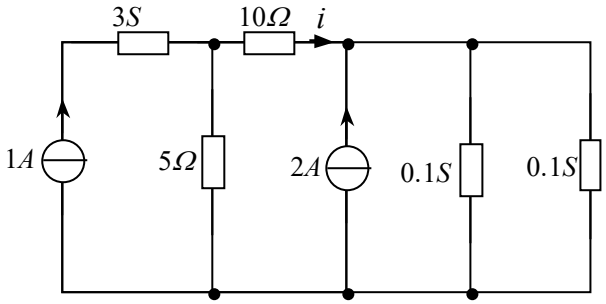
2-9　题 2-9 图示电路.用电源等效变换法求电流 *i*.

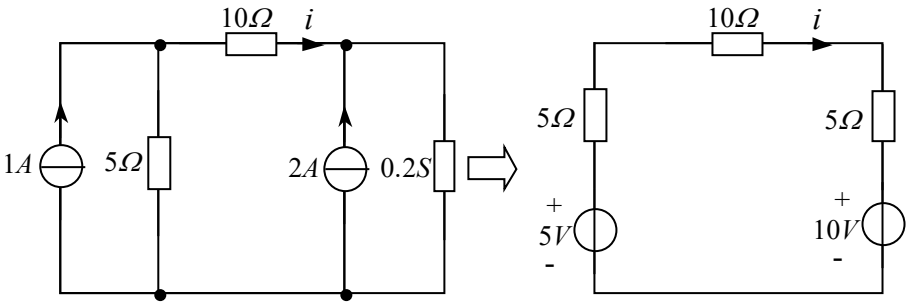


题 2-9 图

解：

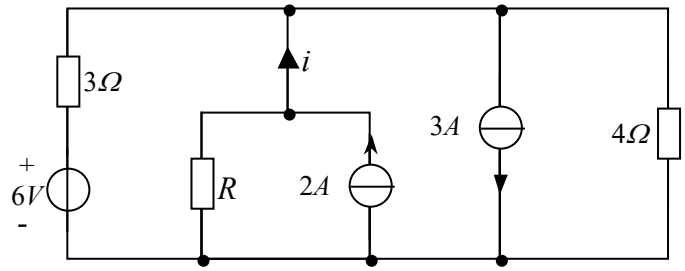






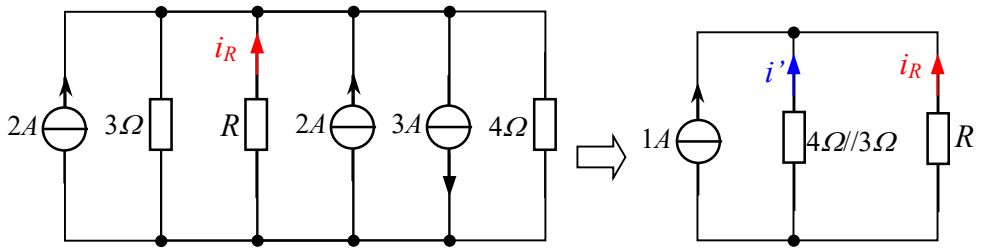
$$\therefore i = \frac{5-10}{5+5+10} = \frac{-5}{20} = -\frac{1}{4}(A)$$

2-10　若题 2-10 图示电路中电流 i 为 1.5A,问电阻 R 的值是多少?



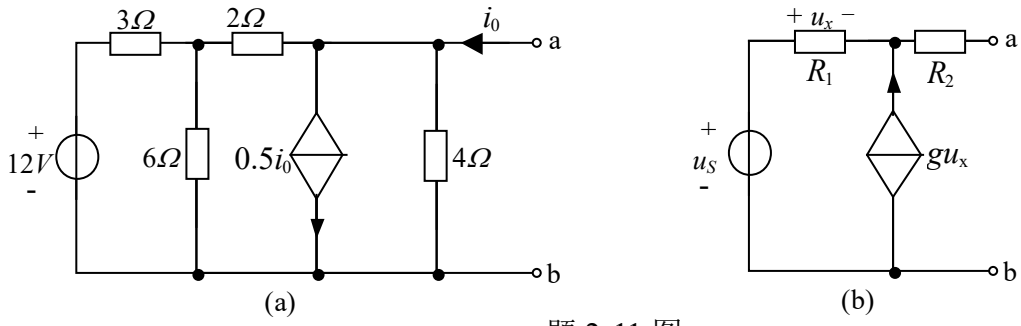
题 2-10 图

解：流过 R 的电流为 i_R=i-2=1.5-2= -0.5(A)，再利用电源等效变换，原电路等效为：



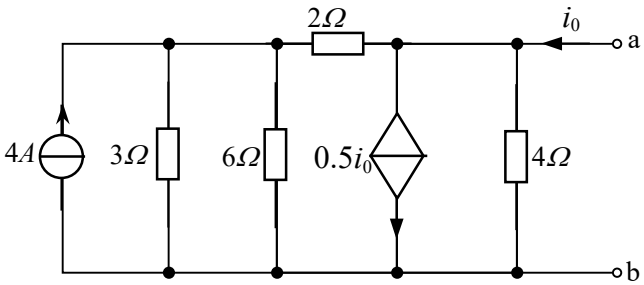
其中 3Ω//4Ω=$\frac{12}{7}$Ω，i'=-1+0.5= -0.5(A)，$\therefore R=\frac{12}{7}(\Omega)$

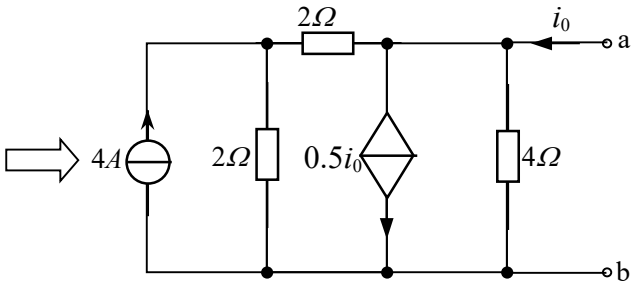
2-11　化简题 2-11 图示电路.

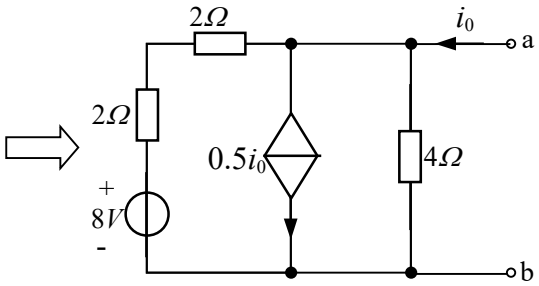


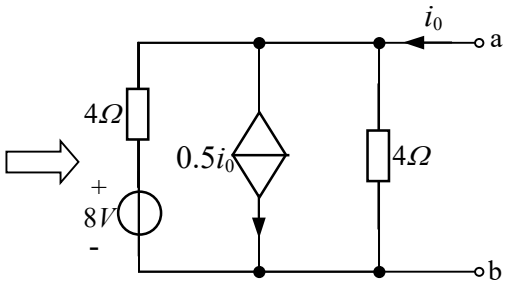
题 2-11 图

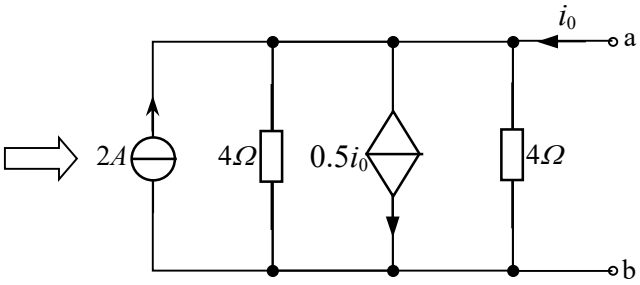
解：(a)图等效为：

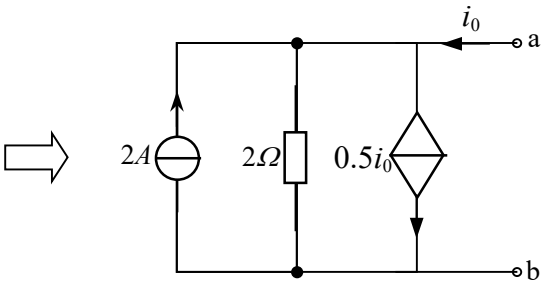


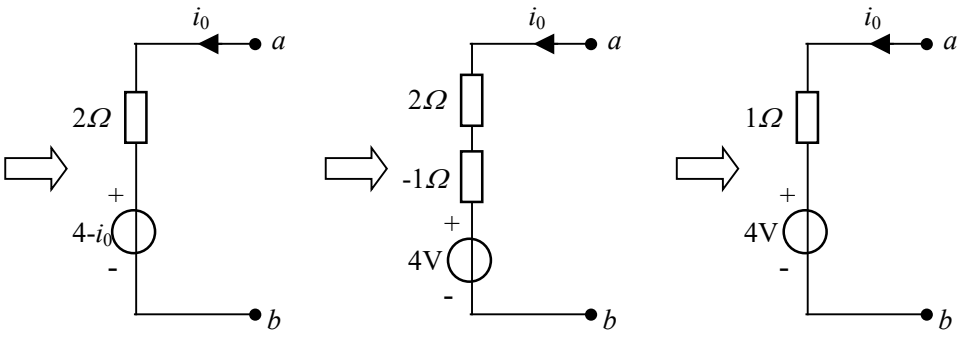

2Ω
i_0
a
4A
2Ω
$0.5i_0$
4Ω
b


2Ω
i_0
a
2Ω
$0.5i_0$
4Ω
+
8V
-
b


i_0
a
4Ω
$0.5i_0$
4Ω
+
8V
-
b

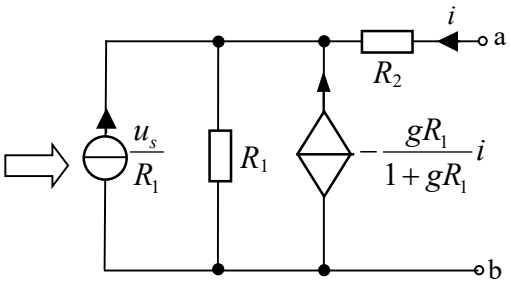

i_0
a
2A
4Ω
$0.5i_0$
4Ω
b

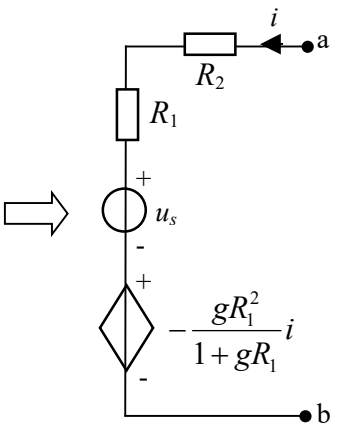

i_0
a
2A
2Ω
$0.5i_0$
b

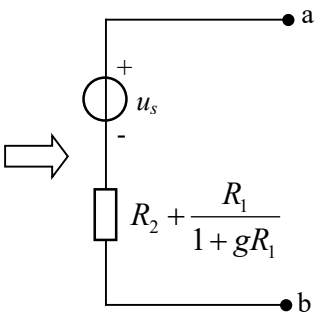


(b)图：设端口电流为 i，则 $\frac{u_x}{R_1}+gu_x+i=0$　　$\therefore u_x=-\frac{R_1}{1+gR_1}i$

原电路变为：

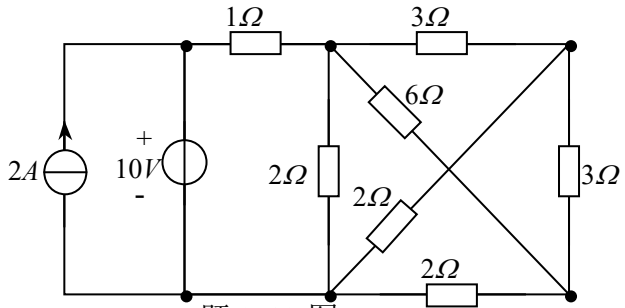






$R_1+(-\frac{gR_1^2}{1+gR_1})=\frac{R_1}{1+gR_1}$

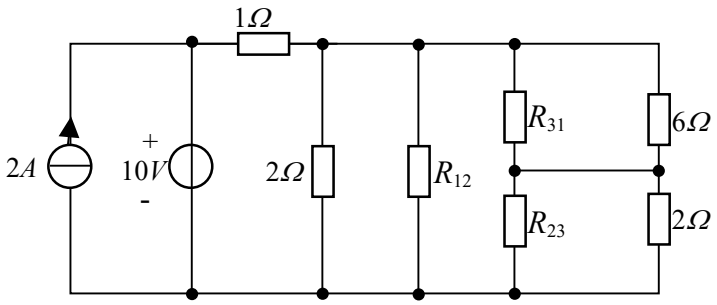
2-12　求题 2-12 图示电路中电流源和电压源提供的功率分别是多少?

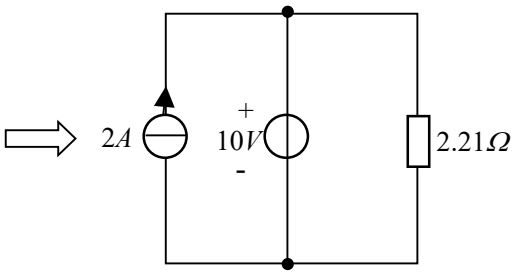


题 2-12 图

解：电流源发出功率为 $P = 2 \times 10 = 20(w)$

原图可变为：





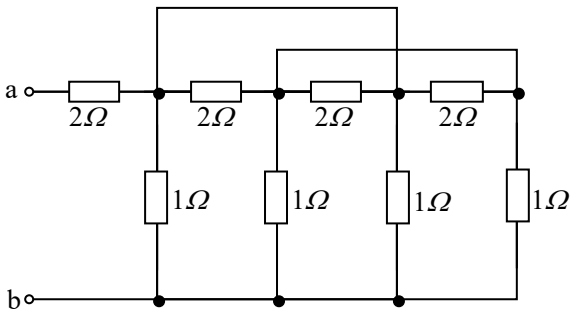
$$R_{12} = \frac{3\times3+2\times3+2\times3}{3} = 7(\Omega), R_{31} = \frac{21}{2}(\Omega), R_{23} = 7(\Omega)$$

$$\therefore R_{总} = 1+2//7//(\frac{21}{2}//6+7//2) = 1+\frac{14}{9}//(\frac{42}{11}+\frac{14}{9}) = 1+1.21 = 2.21(\Omega)$$

$$\therefore P_{总} = \frac{U^2}{R_{总}} = 45.32(w)$$

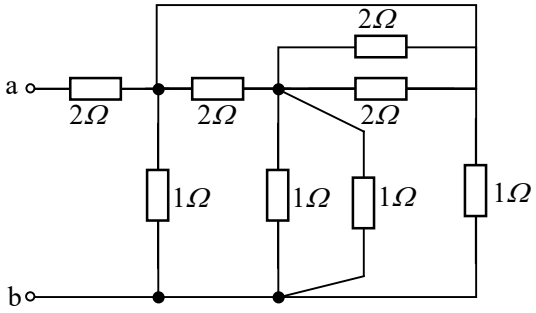
∴电压源发出的功率 P=45.32−20=25.32(w)

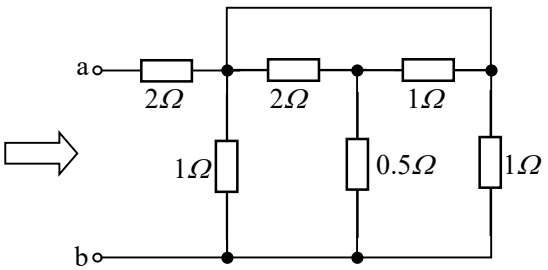
2-13　求题 2-13 图示电路 a、b 端的等效电阻 R_{ab}.

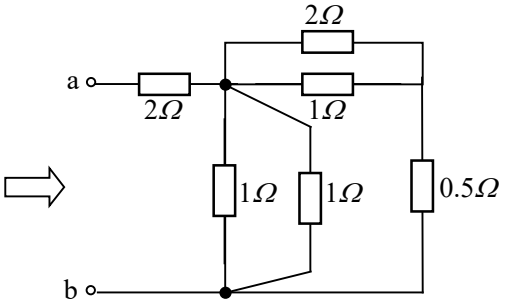


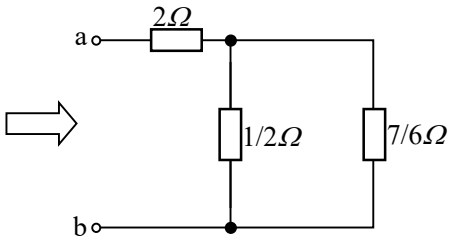
题 2-13 图

解：原电路等效为：









$$\therefore R_{ab} = 2 + (\frac{1}{2} // \frac{7}{6}) = \frac{47}{20} = 2.35(\Omega)$$

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