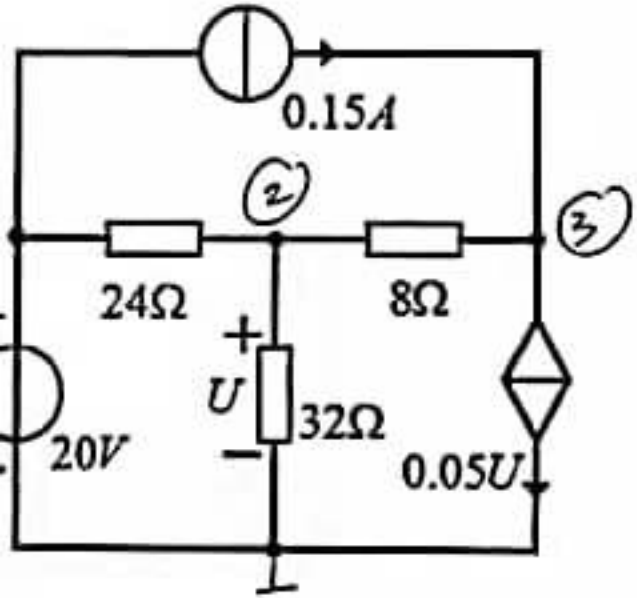
（10 分）求图示电路中受控源的功率。




$U_1 = 20$

$-\frac{1}{24}U_1 + (\frac{1}{24} + \frac{1}{8} + \frac{1}{12})U_2 - \frac{1}{8}U_3 = 0$

$-\frac{1}{8}U_2 + \frac{1}{8}U_3 = 0.15 - 0.05U$

$U_2 = U$

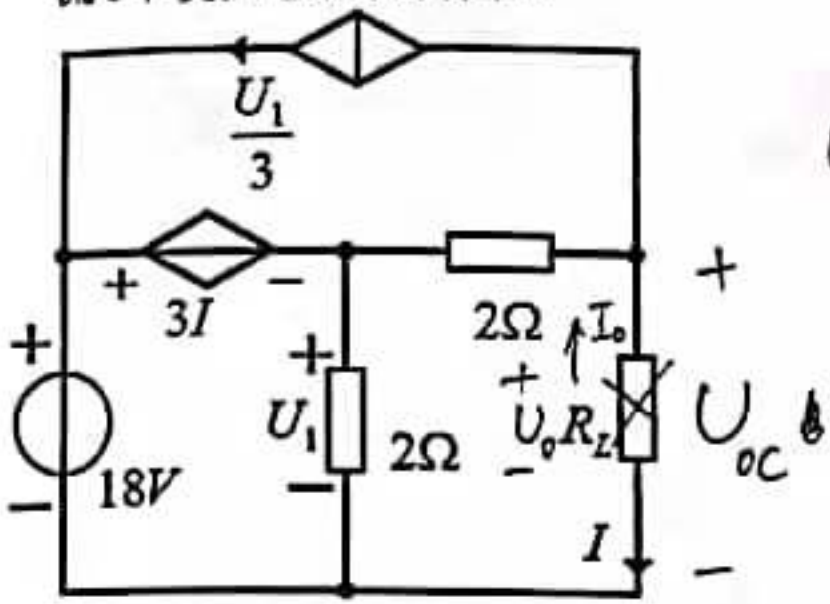
$19U_2 - 12U_3 = 80$

$-3U_2 + 5U_3 = 6$

$U_2 = 8V \quad U_3 = 6V$

$P = 6 \times 0.05 \times 8 = 2.4W$

2、（12 分）电路如图所示，已知负载 $R_L$ 获得最大功率，求此时的电流 I 和受控电流源的功率。




$$U_{OC} = U_1 - \frac{2}{3}U_1 = \frac{1}{3}U_1$$

$$= \frac{1}{3} \times 18 = 6V$$

$$U_0 = 2(I_0 - \frac{1}{3}U_1) + U_1$$

$$3I + U_1 = 0 \quad I = -I_0 \quad U_1 = 3I_0$$

$$U_0 = 2(I_0 - I_0) + 3I_0 = 3I_0$$

$$R_i = \frac{U_0}{I_0} = 3\Omega \qquad R_L = 3\Omega$$

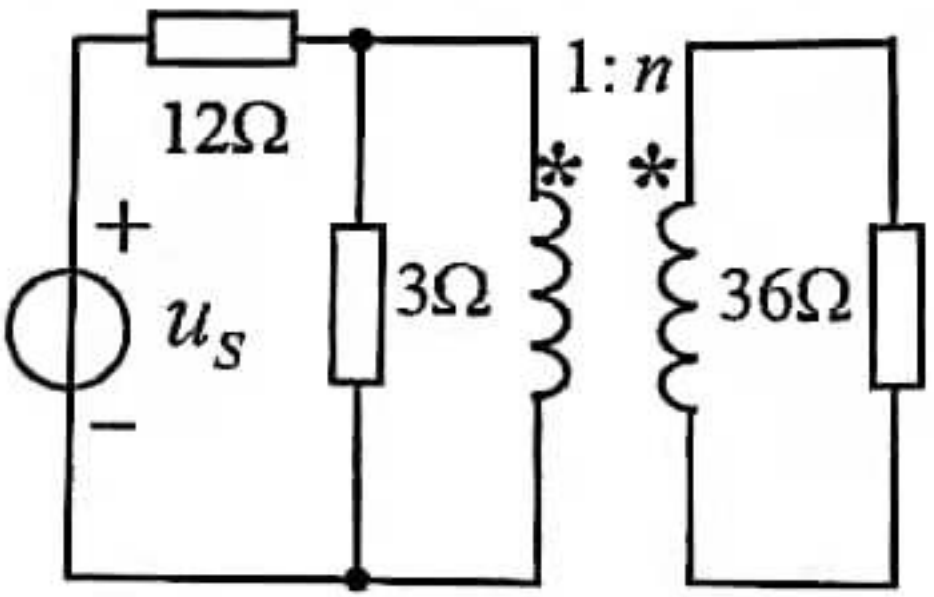
$$P = \frac{36}{4 \times 3} = 3W = I^2 \times 3 \longrightarrow I = 1A$$

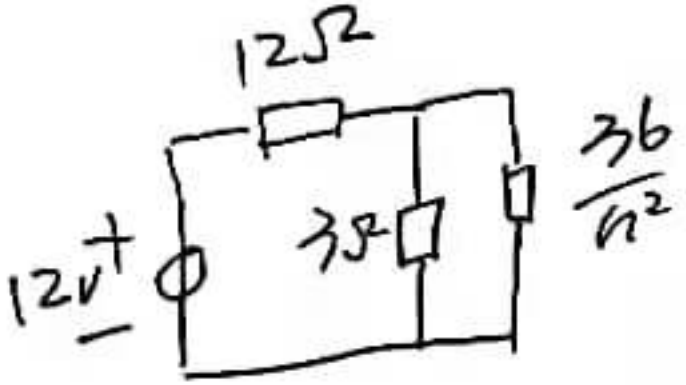
$$18 = 3I + U_1 = 3 + U_1 \qquad U_1 = 15V$$

$$I_{U/3} = 5A$$

$$P = -15 \times 5 = -75W$$

3、（10 分）如图示含理想变压器的电路，$u_S(t)=12\sqrt{2}\sin\omega t\ V$，已知 3 Ω 电阻获得最大功率 Pmax，求此时变压器变比 n 及 Pmax。



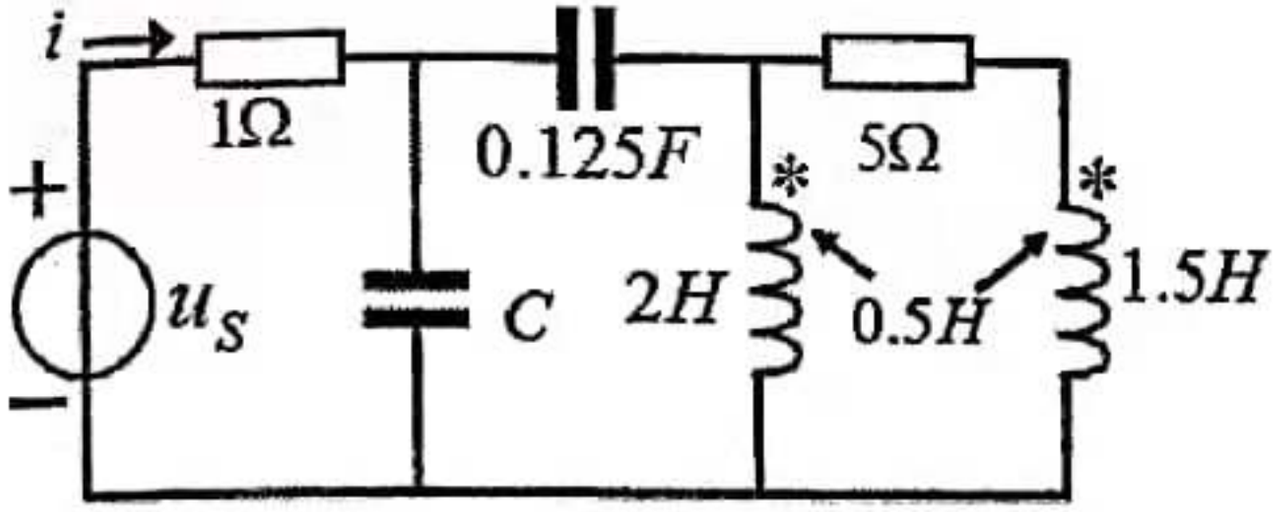



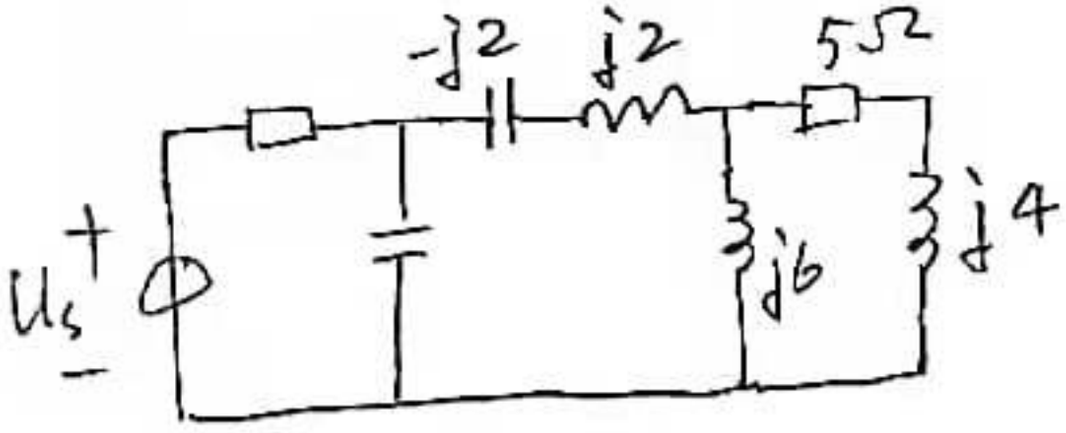

$12 // \frac{36}{n^2} = 3 \qquad n^2 = 9 \qquad n = 3$

$$U_{OC} = \frac{4}{12+4} \times 12 = 3V$$

$$P_{max} = \frac{3^2}{4\times 3} = \frac{3}{4} W$$

4、(12分) 已知电路中 $u_S$ 和 $i$ 同相，$u_S(t)=10\sqrt{2}\sin 4t\ V$，求电容C的值。



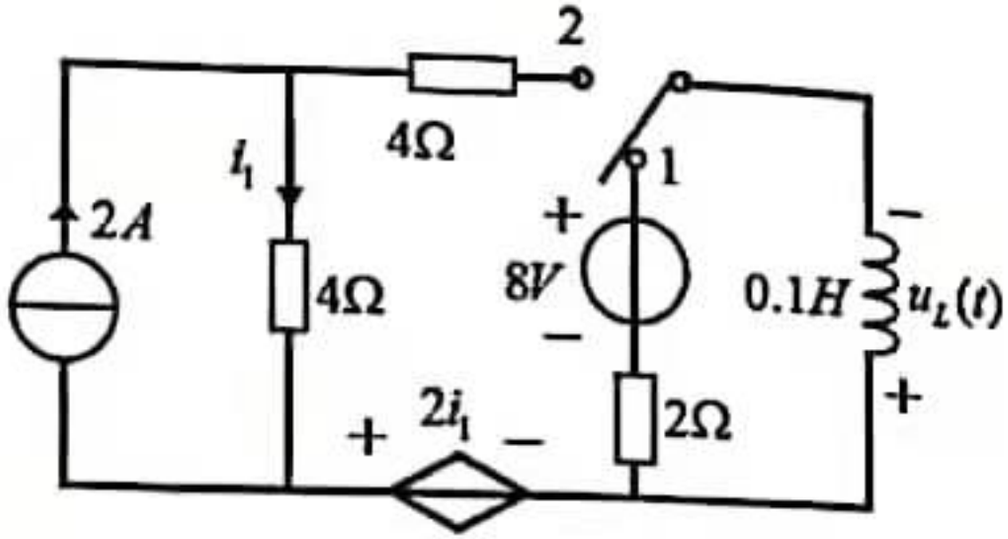




$$Z=\frac{(5+j4)j6}{5+j4+j6}=\frac{-24+j30}{5+j10}$$

$$Y=\frac{1}{Z}=\frac{5+j10}{-24+j30}=0.122-j0.264$$

$$\omega C=0.264 \qquad C=0.066F$$

5、(10分)图示电路开关在位置1时已处于稳态，$t=0$时开关S由1合向2，求$t\geq 0$时的$u_L(t)$。




$$i_L(0^+)=\frac{8}{2}=4A$$

$$U_{oc}=4i_1+2i_1=6i_1=12V$$

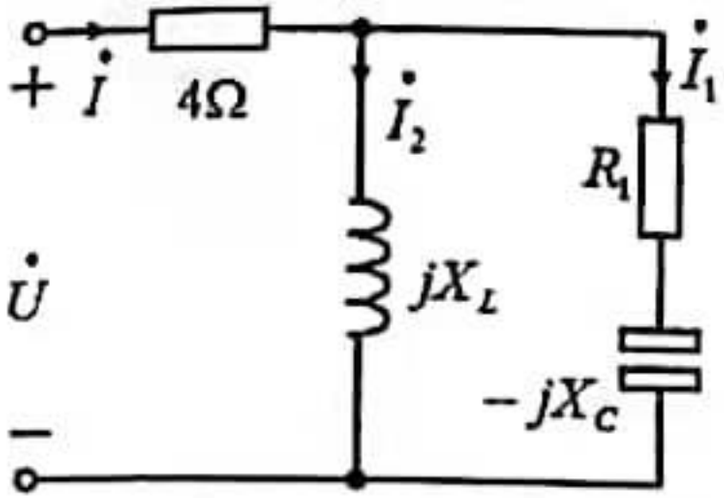
$$R_i=\frac{U_o}{I_o}=10\Omega \qquad i_L(\infty)=1.2A$$

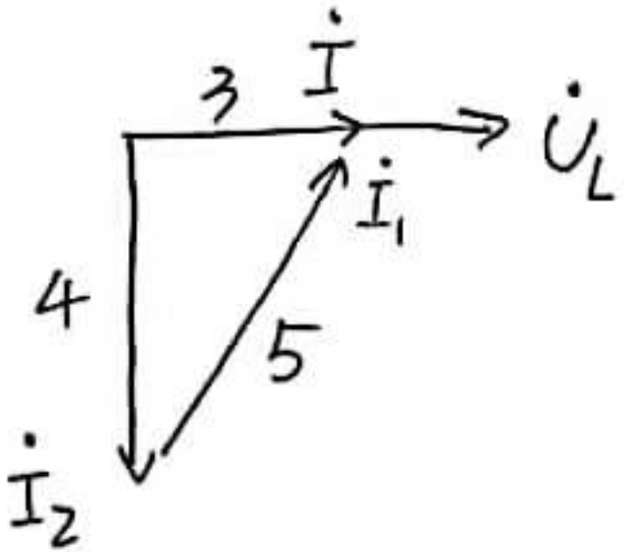
$$\tau=\frac{0.1}{10}=0.01s$$

$$i_L(t)=1.2+2.8e^{-100t}$$

$$u_L(t)=-0.1\frac{di_L}{dt}=28e^{-100t}$$

6、（12 分）如图所示正弦稳态电路，已知 $U=52V$，$I_1=5A$，$I_2=4A$，$I=3A$，求 $R_1$，$X_L$，$X_C$ 和电感的无功功率。




$U_L = 52 - 12 = 40V$

$X_L = \frac{40}{4} = 10\Omega$　　$\dot{I}_1 = 5\angle 53.1^\circ$

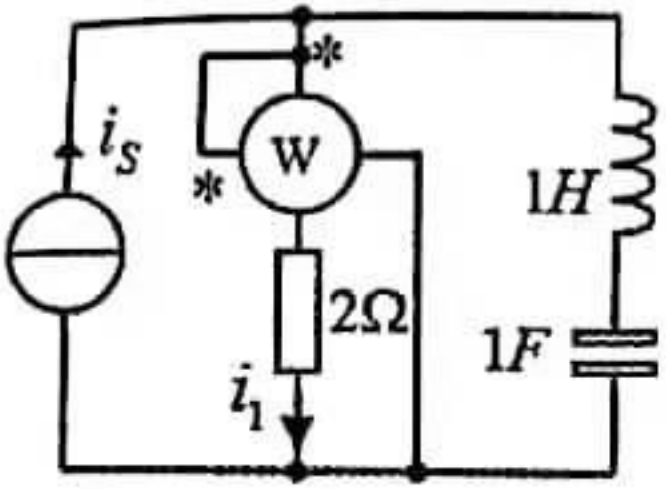
$$\frac{40\angle 0^\circ}{5\angle 53.1^\circ} = 8\angle -53.1^\circ = 4.8 - j6.4$$

$R_1 = 4.8\Omega$　　$X_C = 6.4\Omega$

$Q_L = 4^2 \times 10 = 160\ Var$

7、（10分）如图所示电路，已知

$i_s = 10 + 15\sqrt{2}\sin t + 10\sqrt{2}\sin(2t - 30°)A$，求$I_1$以及$i_1(t)$和功率表的读数。



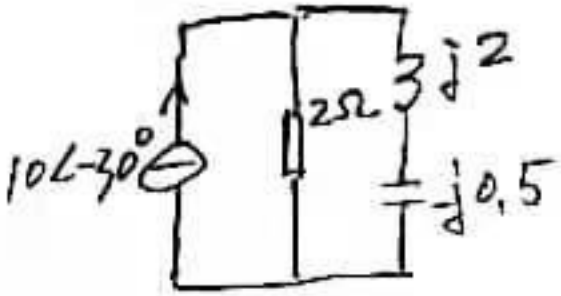

① 10A 作用

$\dot{I}_1' = 10A$　$P_1' = 200W$

② $15\sqrt{2}\sin t$ 作用

$\dot{I}_1'' = 0$　$P_1'' = 0$

③ $10\angle -30°$ 作用




$$\dot{I}_1''' = \frac{j1.5}{2+j1.5} \times 10\angle -30° = \frac{j3}{4+j3} \times 10\angle -30°$$

$$= 6\angle 23.2°$$

$P_1''' = 36 \times 2 = 72W$

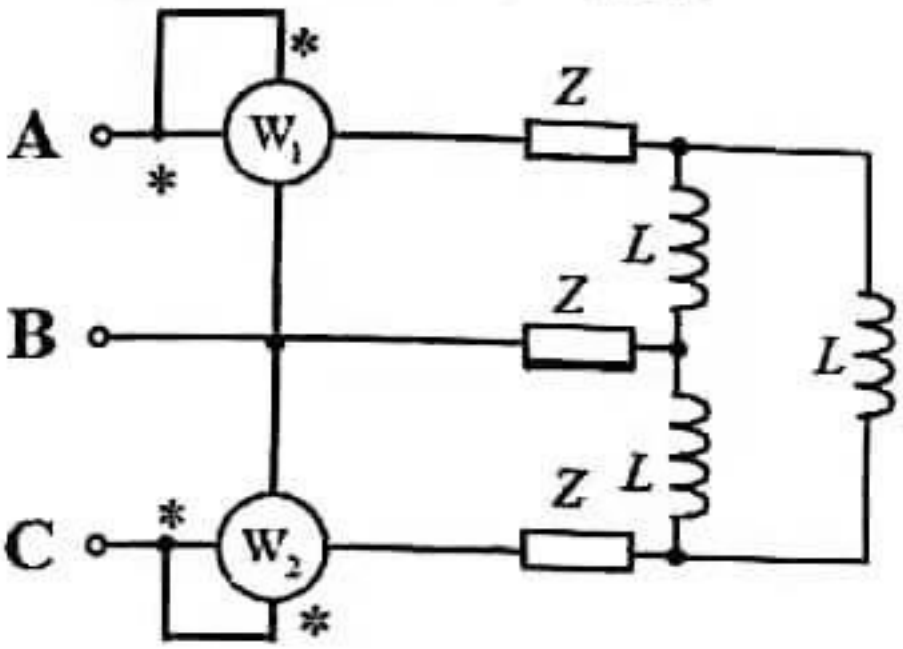
$I_1 = \sqrt{10^2 + 6^2} = 11.66A$　$P = 200 + 72 =$

$i_1(t) = 10 + 6\sqrt{2}\sin(2t + 23.2°)$

8、（12分）如图为三相电路，线电压380V，$Z=22-j64\ \Omega$，$L=\frac{3}{\pi}\ H$

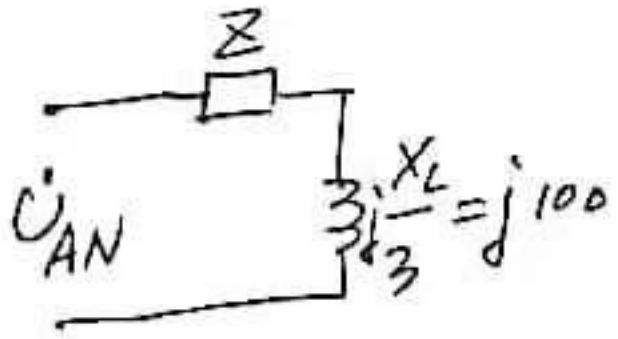
（1）求电感上的电流的有效值；

（2）求功率表 $W_1$ 和 $W_2$ 的读数。




$X_L = 2\pi fL = 100\pi \times \frac{3}{\pi} = 300\Omega$

$\dot{U}_{AN} = 220\angle 0^\circ$




$$\dot{I}_A = \frac{220\angle 0^\circ}{22-j64+j100} = \frac{220}{22+j36} = 5.2\angle -58.6^\circ$$

$\dot{I}_C = 5.2\angle 61.4^\circ$

① $I_L = \frac{5.2}{\sqrt{3}} = 3A$　　$\dot{U}_{AB} = 380\angle 30^\circ$

② $P_{W_1} = U_{AB} \cdot I_A \cos\varphi_1 = 380 \times 5.2 \times \cos(30^\circ + 58.6^\circ)$

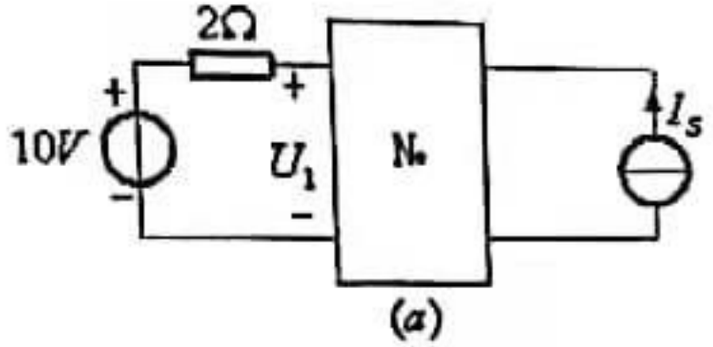
$= 48.2\ W$

$\dot{U}_{CB} = 380\angle 90^\circ$

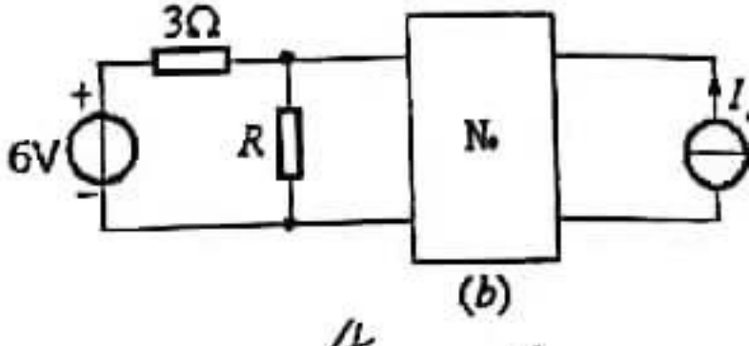
$P_{W_2} = U_{CB} \cdot I_C \cos\varphi_2 = 380 \times 5.2 \times \cos(90^\circ - 61.4^\circ)$

$= 1734.9\ W$

9、（12 分）在图(a)、(b)所示电路中，$N_0$ 为同一不含独立电源的电阻性网络，已知当 $I_S=0$ 时，$U_1=6V$；当 $I_S=3A$ 时，$U_1=12V$。求图(b)电路中的 $I_S=6A$ 时，R 为何值其获得最大功率 Pmax，并求出 Pmax。



(a)

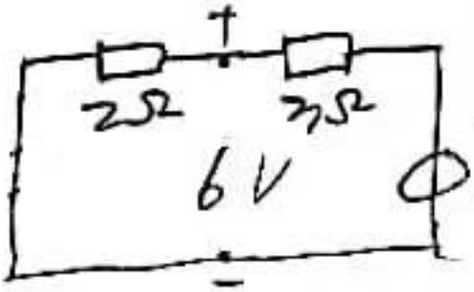


(b)

$I_S=0$ $U_1=6V$ $10-6=4V$ $I=\frac{4}{2}=2A$

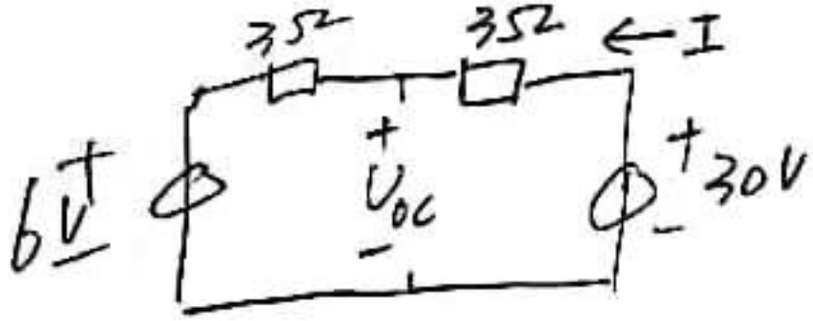
$R_i=\frac{6}{2}=3\Omega$

$I_S=3A$. $U_1=12V$. $I_S$ 等效为 6V




$\frac{2}{5}U'_{OC}=6$

$U'_{OC}=15V$. $I_S=6A$. $U''_{OC}=30V$




$I=\frac{30-6}{6}=4A$

$U_{OC}=6+3\times4=18V$

$R_i=1.5\Omega$ $P_{max}=\frac{18^2}{4\times1.5}=54W$