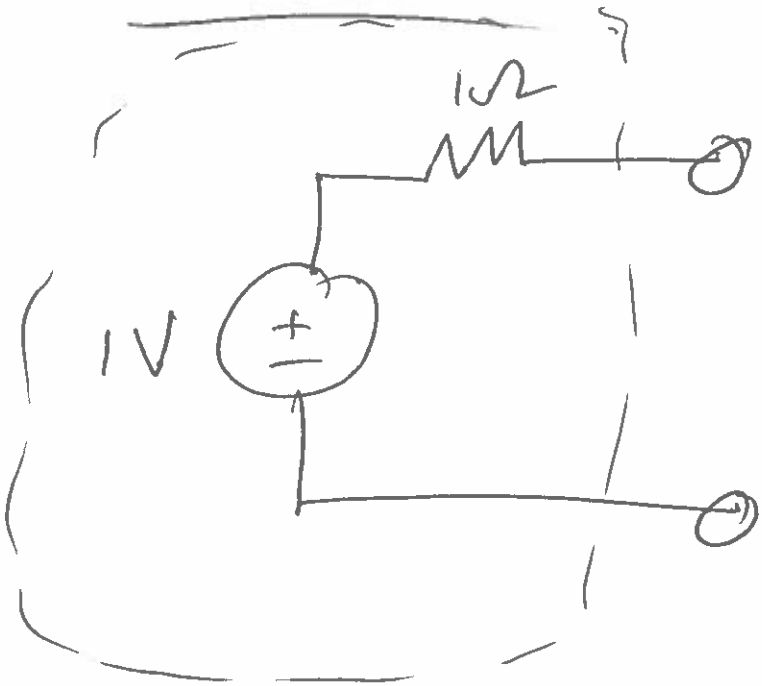
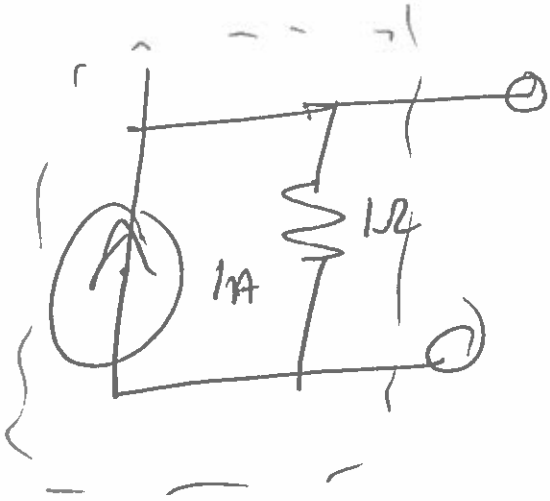
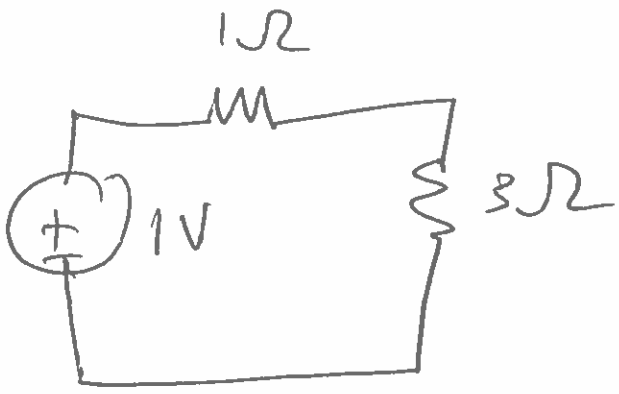
Box A



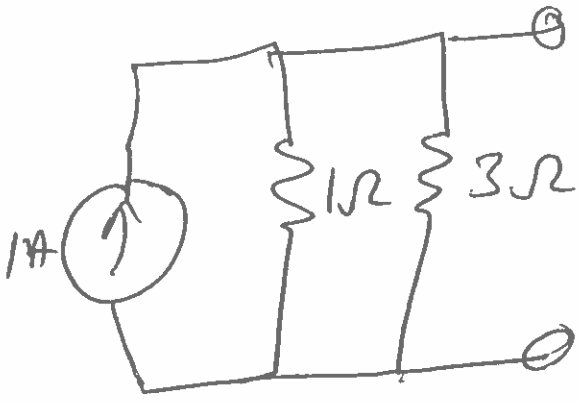
Box B



How do you distinguish if you have A single wire?



$V_{3\Omega} = .75V$



$V_{3\Omega} = i_{3\Omega}(3\Omega)$

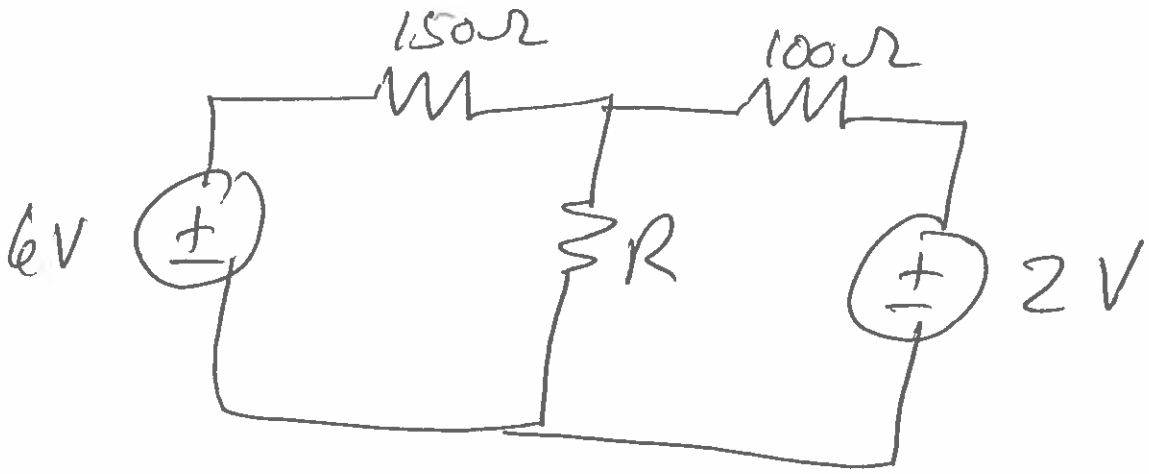
$= (\frac{1}{4}A)(3\Omega)$

$= .75V$

Answer Short The Terminals

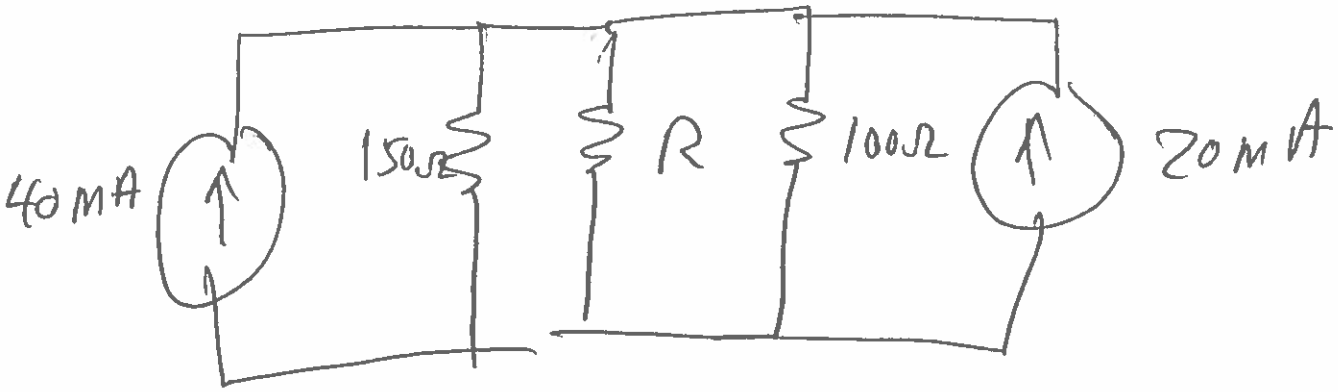
Box A Heats up

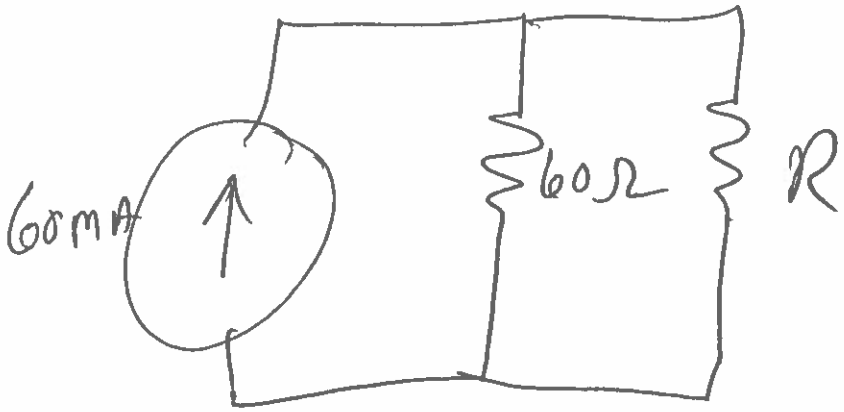
Box B Cools down



What R Gives Max Power in R?

What is That P_{max}?





$$\frac{2+3}{300} = \frac{5}{300\Omega}$$

$$\Rightarrow R_{eff} = 60\Omega$$

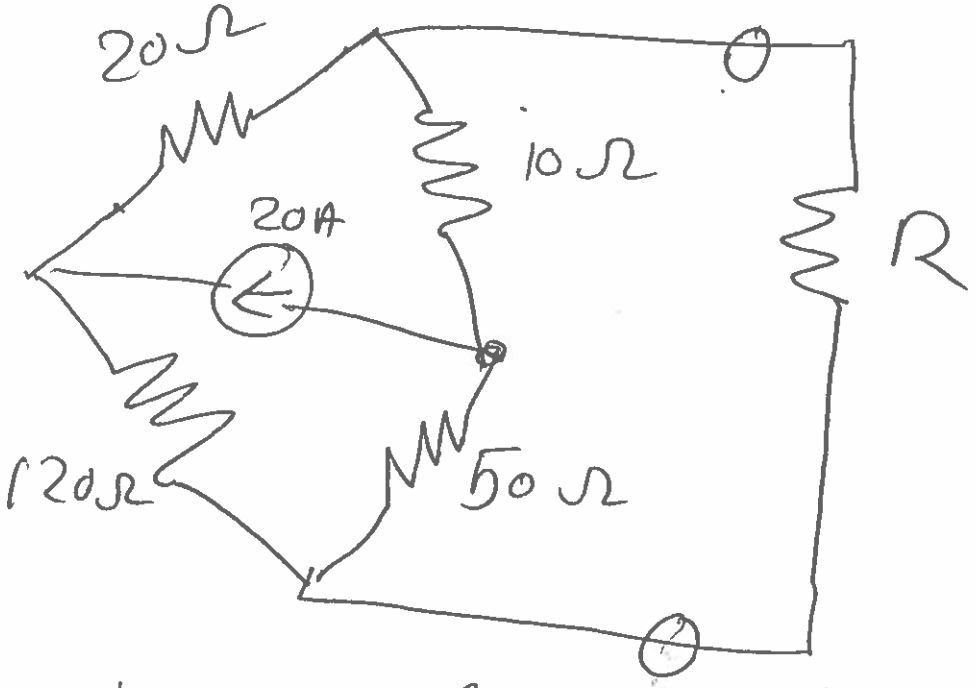
$R_{\text{Max Power}} = \boxed{60\,\Omega}$

$P_{max} = i^2 R = (30\,mA)^2 (60\,\Omega)$

$(900 \times 10^{-6}\,A)(60\,\Omega)$

$= 54000\,\cancel{\Omega}\; 10^{-6}\,W$

$= \boxed{54\,mW}$

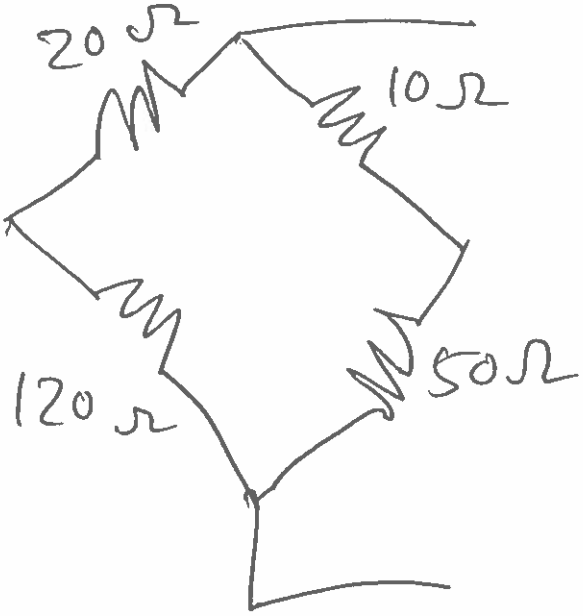


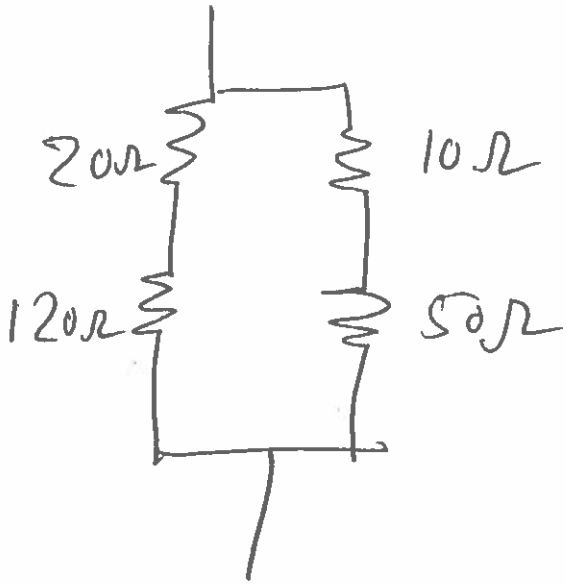
What R for max power.?

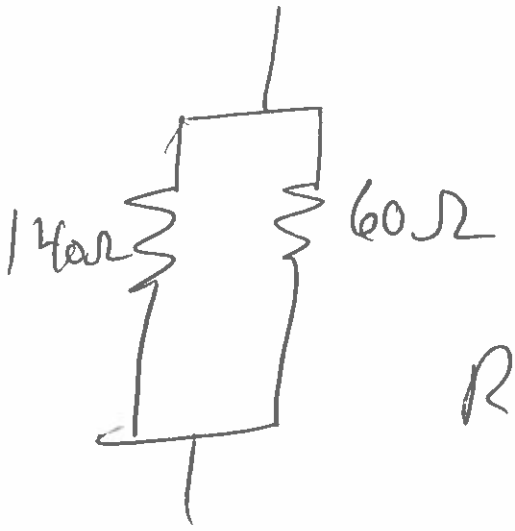
What is max Power?

First Find Equivalent Circuit

Deactive Current Source





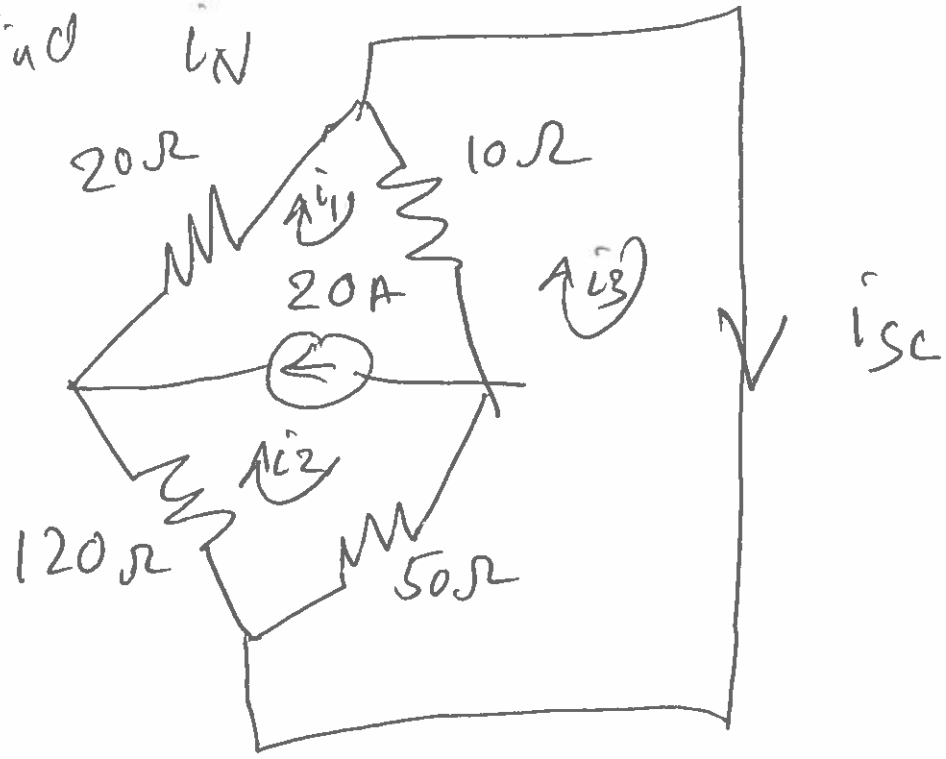


$$R_{eff} \Rightarrow \frac{1}{R_{eff}} = \frac{1}{140\Omega} + \frac{1}{60\Omega}$$

$$\text{or} \quad R_{eff} = \frac{140\Omega(60\Omega)}{140\Omega + 60\Omega} = 42\Omega$$

$$\boxed{R_{load} = 42\Omega}$$

Find i_N



$$i_{sc} = i_3$$

$$i_1 - i_2 = 20A$$

$$0 = i_1(20\Omega + 10\Omega) + i_2(120\Omega + 50\Omega) - i_3(10\Omega + 50\Omega)$$

$$0 = i_3(10\Omega + 50\Omega) - i_1(10\Omega) - i_2(50\Omega)$$

Solve in MATLAB

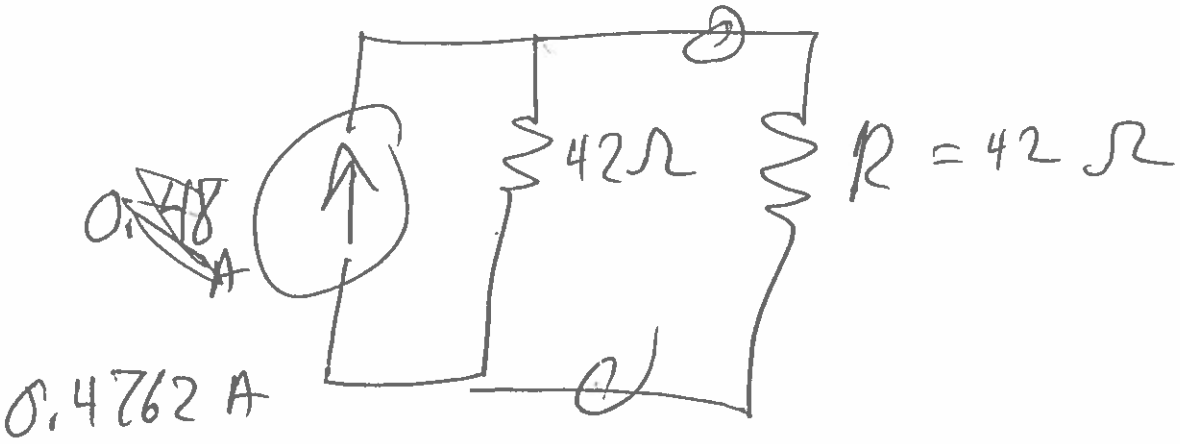
$$i_1 = 17.1429\ A$$

$$i_2 = -2.8571\ A$$

$$i_3 = 0.4762\ A$$

$$i_5 = 0.4762\ A$$

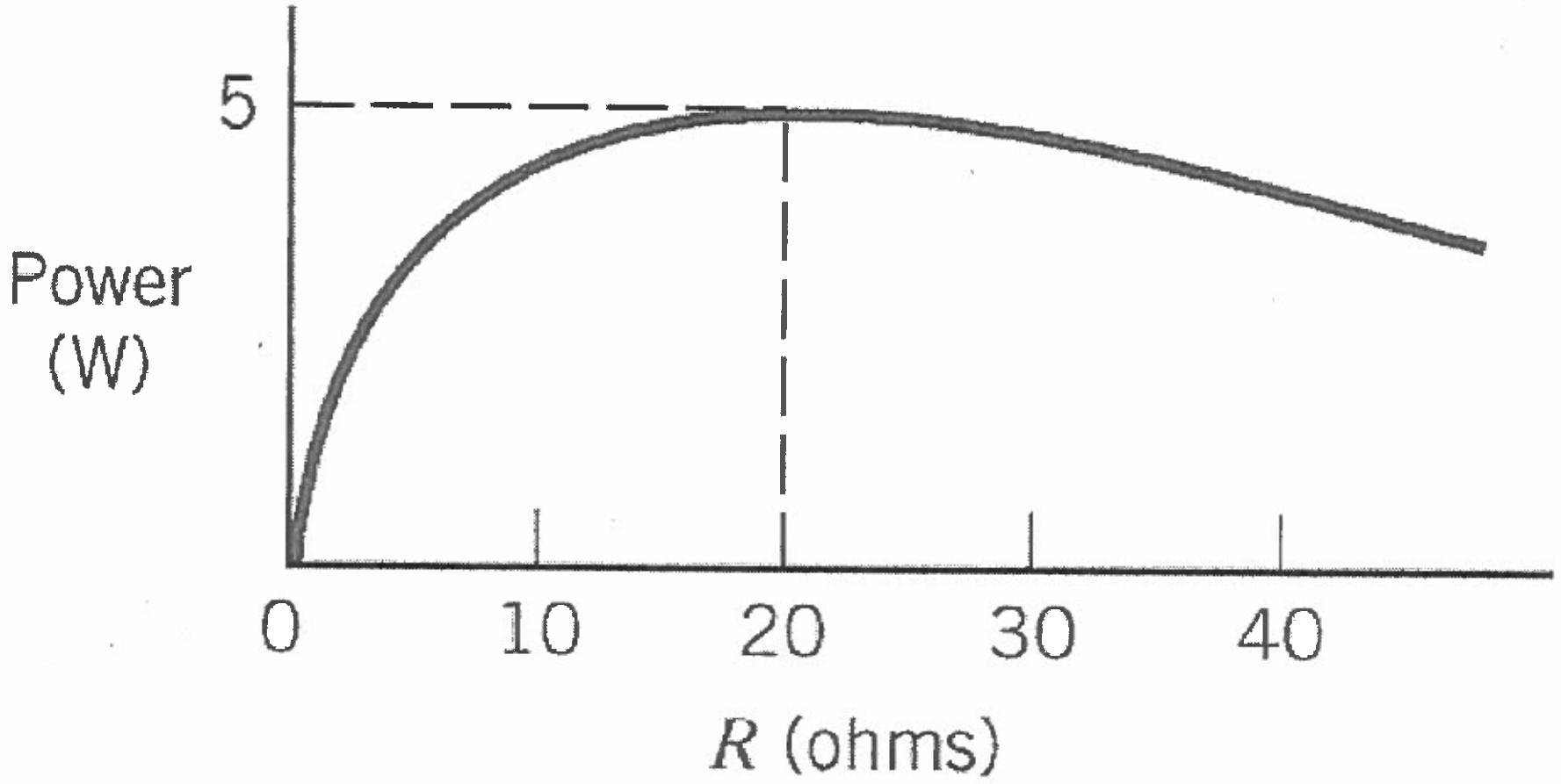
Equivalent circuit is



$$R_{max} = 42\Omega$$

$$P_{max} = \left(\frac{.4762\,A}{2}\right)^2 (42\Omega)$$

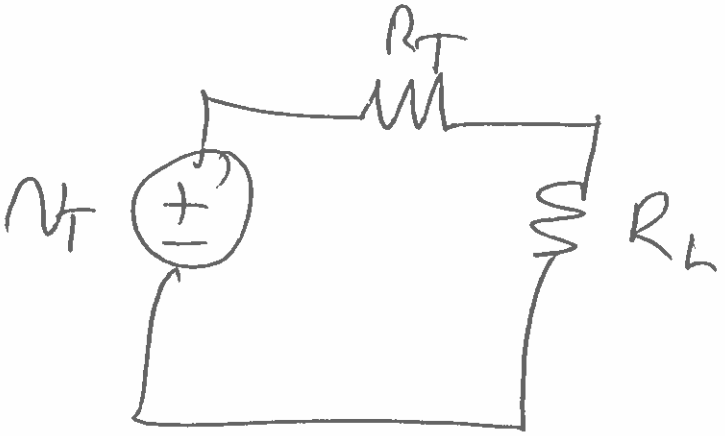
$$\boxed{P_{max} = 2.38\,W}$$



what is Thevenin circuit?

$R_L = 20\,\Omega$ That is where Power is max.

$$P_{max} = 5W = i^2 R = \frac{V^2}{R}$$



$$i = \frac{V_T}{R_T + R_L}$$

$$i = \frac{V_T}{2R}$$

$V_T = 20V$
$R_T = 20\,\Omega$

$$P_{max} = i^2 R = \left(\frac{V_T}{2R}\right)^2 R$$

$$P_{max} = \frac{V_T^2}{4R} \qquad V_T = \sqrt{P_m\, 4R}$$

$$V_T = \sqrt{(5W)(4)(20\,\Omega)} = \sqrt{400}$$

$$\Rightarrow V_T = 20V$$