This part of the experiment is prepared with Online LaTeX Editor Overleaf. Visit the website for the code here:

https://www.overleaf.com/read/gqxmprgkvgfd#1879d9

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1. PRELIMINARY WORK

1.1 For the circuit given in Figure 1, find the dissipated and generated powers.

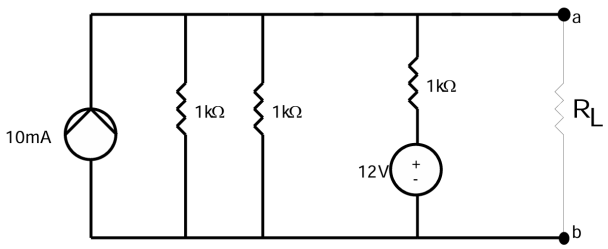

Figure 1.

Answer: First, name some points and resistors for ease. After that, let's use the node-voltage method.

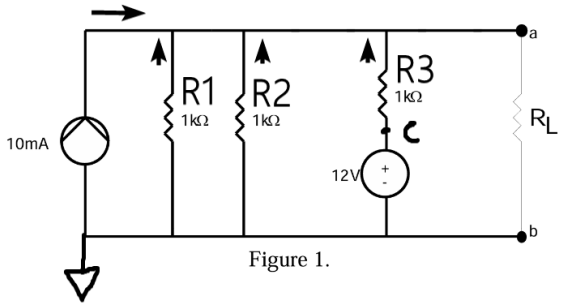

Figure 1.

For node a:

$$10\text{mA} - \frac{\text{V}_\text{a}}{1\text{k}\Omega} - \frac{\text{V}_\text{a}}{1\text{k}\Omega} + \frac{\text{V}_\text{c} - \text{V}_\text{a}}{1\text{k}\Omega} = 0 \ (1)$$

We also know that $\text{V}_\text{c} = 12\text{V}$ (2).

Compare (1) and (2), we get $\text{V}_\text{a} = \frac{22}{3}\text{V}$.

Now, we can find the generated and dissipated power.

$$\boxed{\text{P}_{\text{R}_3} = \frac{\left(12 - \frac{22}{3}\right)^2 \text{V}^2}{1\text{k}\Omega} = \frac{196}{9}\text{mW}}$$

$$\boxed{\mathrm{P_{R_1}} = \frac{\left(\frac{22}{3}\right)^2 \mathrm{V}^2}{1\mathrm{k}\Omega} = \frac{484}{9}\mathrm{mW}}$$

$$\boxed{\mathrm{P_{R_2}} = \frac{\left(\frac{22}{3}\right)^2 \mathrm{V}^2}{1\mathrm{k}\Omega} = \frac{484}{9}\mathrm{mW}}$$

$$\boxed{\mathrm{P_{10mA}} = -\left(\frac{22}{3}\mathrm{V}\right)(10\mathrm{mA}) = -\frac{220}{3}\mathrm{mW}}$$

Find the power generated by the voltage source.

$$\mathrm{V_c} - \mathrm{V_a} = \mathrm{V_{R_3}} \;\rightarrow\; \mathrm{V_{R_3}} = \frac{14}{3}\mathrm{V}$$

$$\mathrm{I_{R_3}} = \frac{\mathrm{V_{R_3}}}{\mathrm{R_3}} = \frac{14}{3}\mathrm{mA}$$

$$\boxed{\mathrm{P_{12V}} = -(12\mathrm{V})\left(\frac{14}{3}\mathrm{mA}\right) = -56\mathrm{mW}}$$

1.2 Show that the total power generated by the sources is equal to the total power dissipated by the resistors.

Answer:

$$\mathrm{P_{generated}} = \left(-\frac{220}{3} - 56\right)\mathrm{mW} = -\frac{388}{3}\mathrm{mW}$$

$$\mathrm{P_{dissipated}} = \left(\frac{196}{9} + \frac{484}{9} + \frac{484}{9}\right)\mathrm{mW} = \frac{388}{3}\mathrm{mW}$$

$$\boxed{|\mathrm{P_{dissipated}}| = |\mathrm{P_{generated}}| = \frac{388}{3}\mathrm{mW}}$$