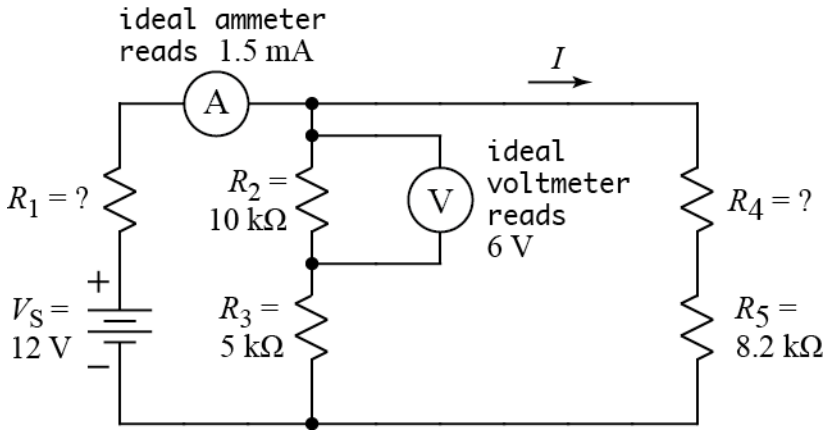
Ex:



Find the values of the following quantities in the above circuit.

a) I

b) R_4

c) P_{R1} (the power dissipated by R_1)

Sol'n: a) We use Ohm's law to calculate the current through R_2.

$$I = \frac{6\,\text{V}}{10\,\text{k}\Omega} = 0.6\,\text{mA}$$

To find I, we use a current summation at the top center node.

$$1.5\,\text{mA} = 0.6\,\text{mA} + I$$

or

$$I = 1.5\,\text{mA} - 0.6\,\text{mA} = 0.9\,\text{mA}$$

b) The total voltage across R_2 and R_3 is related to the voltage across R_2 by a voltage divider formula.

$$6\,\text{V} = V_{R2,3} \cdot \frac{10\,\text{k}\Omega}{15\,\text{k}\Omega}$$

or

$$V_{R2,3} = 6\,\text{V} \cdot \frac{15\,\text{k}\Omega}{10\,\text{k}\Omega} = 9\,\text{V}$$

This voltage appears across R_4 and R_5. Using I and $V_{R2,3}$ and Ohm's law yields an equation for R_4.

$$I = \frac{V_{R2,3}}{R_4 + R_5} = \frac{9V}{R_4 + 8.2\,\mathrm{k\Omega}} = 0.9\,\mathrm{mA}$$

or

$$R_4 + 8.2\,\mathrm{k\Omega} = 10\,\mathrm{k\Omega}$$

or

$$R_4 = 1.8\,\mathrm{k\Omega}$$

c) From a V-loop on the left side, we find the voltage across R_1.

$$12\,\mathrm{V} - V_{R1} = 9\,\mathrm{V}$$

or

$$V_{R1} = 3\,\mathrm{V}$$

We know the current is 1.5 mA, so we can compute the power in R_1.

$$p_{R1} = 1.5\,\mathrm{mA} \cdot 3\,\mathrm{V} = 4.5\,\mathrm{mW}$$