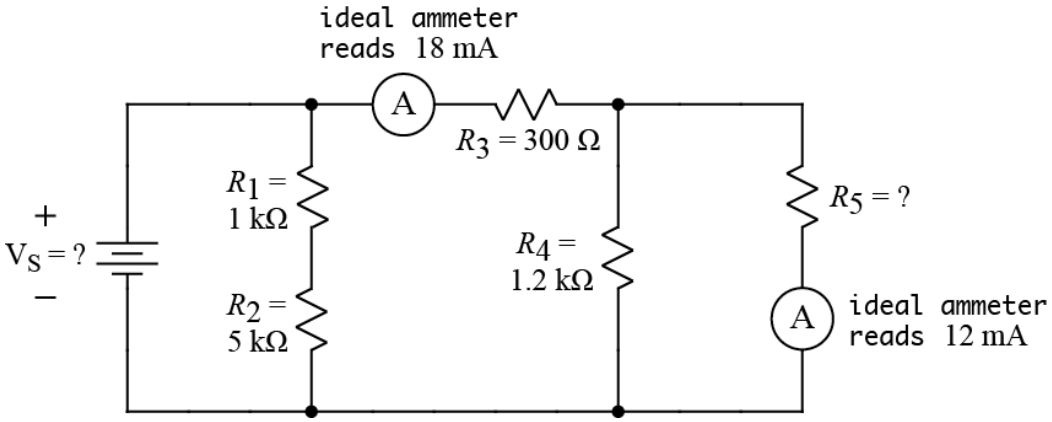
Ex:



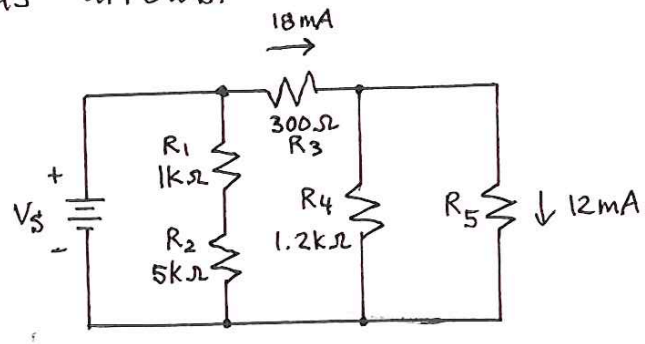
Find the values of the following quantities of the above circuit.

a) R_5

b) V_S

c) P_S (the power delivered by the V_S source)

Soln a) We first redraw the circuit to show currents as arrows.



Q. How do we know the direction of the current?
A. Since V_s is the only source, current will flow out the + terminal and in the − terminal. The current through R_1 and R_2 must flow down, since V_s is across them with + at the top. Since R_4 and R_5 are in parallel, with the same V across them, the current in both is in the same direction, and this must be the direction of 18mA.

Current must flow to the right in R_3, since R_3 is connected to the + of V_S on the left side.

Now we use Ohm's law and Kirchhoff's laws to deduce other quantities.

At the top right node, 18 mA flows in, so 18 mA must flow out. Thus, we have 6 mA flowing down through R_4.

$$i_{R4} = 6\,mA$$

By Ohm's law, the voltage drop across R_4 is $V_{R4} = i_{R4} R_4 = 6\,mA \cdot 1.2k\Omega = 7.2V$.

Since R_4 is in parallel with R_5, we also have 7.2V across R_5. We find R_5 using Ohm's law:

$$\boxed{R_5 = \frac{7.2V}{12mA} = 600\,\Omega \text{ or } 0.6k\Omega}$$

b) Now we can use Ohm's law to find the voltage across R_3, and then we can use a V-loop to find V_S. (outsid V-loop, that is.)

$$V_{R3} = 18\,mA \cdot 300\Omega = 5.4V$$

$$\boxed{V_S = 7.2V + 5.4 = 12.6V}$$

c) The total current flowing out of V_S is I_{R1} plus 18mA: $I_{R1} = \frac{V_S}{1k\Omega + 5k\Omega} = \frac{12.6V}{6k\Omega} = 2.1\,mA$

$$P_S = V_S I_S = 12.6V\,(2.1mA + 18mA) = 253.26\,mW$$