Name: Key

Practice – 21.1 Resistors in Series and Parallel

1. You have ten 275-Ω resistors.

A. What is the resistance of these resistors if they are connected in series?

$R_{eq} = R_1 + R_2 + \ldots + R_{10} = 10(275\,\Omega) = \boxed{2750\,\Omega}$

B. A. What is the resistance of these resistors if they are connected in parallel?

$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots + \frac{1}{R_{10}} = \frac{10}{275\,\Omega} \Rightarrow R_{eq} = \boxed{27.5\,\Omega}$

2. You have a 1.00×10^2-Ω resistor, a 2.50-kΩ resistor and a 4.00-kΩ resistor.

A. What is the resistance of these resistors if they are connected in series?

$R_{eq} = \sum_i R_i \Rightarrow R_{eq} = 1.00\times10^2 + 2.50\times10^3 + 4.00\times10^3\,\Omega$

$= \boxed{6.60\times10^3\,\Omega} = 6.60\,k\Omega$

B. A. What is the resistance of these resistors if they are connected in parallel?

$\frac{1}{R_{eq}} = \sum_i \frac{1}{R_i} \Rightarrow R_{eq} = \frac{1}{0.100\,k\Omega + \frac{1}{2.50\,k\Omega} + \frac{1}{4.00\,k\Omega}}$

$\Rightarrow R_{eq} = \boxed{93.9\,\Omega}$

3. What are the largest and smallest resistances you can obtain by connecting a 36.0-Ω, a 50.0-Ω and a 700- Ω resistor together?

$R_{largest} = R_{series} = 36.0 + 50.0 + 700 = \boxed{786\,\Omega}$

$R_{smallest} = R_{parallel} \Rightarrow \frac{1}{R_{eq}} = \frac{1}{36} + \frac{1}{50} + \frac{1}{700} \Rightarrow R_{eq} = \boxed{20.3\,\Omega}$

4. An 1800-W toaster, a 1400-W electric frying pan, and a 75-W lamp are plugged into the same outlet in a 15-A, 120-V circuit. (Note: The three devices are in parallel when plugged into the same socket.)

A. What current is drawn by each device? $P = IV \Rightarrow I = \frac{P}{V}$

$I_{toaster} = \frac{1800W}{120V} = 15.0A$ $I_{lamp} = \frac{75W}{120V} = 0.63A$

$I_{frypan} = \frac{1400}{120V} = 11.7A$

B. Will this combination blow the 15-A fuse?

$I_{toaster} + I_{frypan} = 26.7A > 15A$ Yes

5. You have a 48.0-V battery and 24.0-Ω and 96.0- Ω resistors.

A. Find the current and power for each resistor when connected in series.

$I = \frac{V}{R} = \frac{48.0V}{24.0 + 96.0\Omega} = 0.400A = I_{24\Omega} = I_{96\Omega}$

$P_{24\Omega} = I^2R = (0.400A)^2(24.0\Omega) = 3.84W$ $P_{96} = (0.400A)^2(96.0\Omega) = 15.4W$

B. Find the current and power for each resistor when connected in parallel.

$I_{24\Omega} = \frac{V}{R} = \frac{48.0V}{24.0\Omega} = 2.00A$ $I_{96} = \frac{48.0V}{96.0\Omega} = 0.500A$

$P_{24\Omega} = IV = (2.0A)(48.0V) = 96.0W$ $P_{96} = (0.500A)(48.0V) = 24.0W$