**E12: Equivalent resistance and power**

**Materials:**

Power supply, multimeter, resistors, paper, wires, switch

**Initial definitions and givens:**

**Equivalent resistor:** a single resistor that can replace two or more resistors in a circuit with no change in the current supplied by the battery or power supply.

**Power:** the rate that energy is supplied or dissipated. The energy supplied by a battery of power supply is calculated by multiplying current times voltage. The unit of power is the **watt**. \( P \) (in watts) = \( I \) (in amps) times \( V \) (in volts). Power is dissipated in a resistor as heat or in a bulb as heat and light.

**Initial Instructions and questions:**

1. The general rule for finding the equivalent resistor for a number of resistors in series is
   \[ R_{eq} = R_1 + R_2 + R_3 + ... \]

2. Using your multimeter, re-measure all four resistors. Then measure the resistance of two, three, and four resistors in series. Does the formula work?

3. The general rule for finding the equivalent resistor for a number of resistors in parallel is
   \[ \frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + ... \]

4. Using your multimeter, measure the resistance of two, three, and four resistors in parallel. Does the formula work?

5. Using your data from E11 for two resistors wired in series, calculate the power supplied by the power supply and the power dissipated in each resistor.

6. Using your data from E11 for two resistors wired in parallel, calculate the power supplied by the power supply and the power dissipated in each resistor.

7. How is the supplied power related to the power dissipated in all the resistors?