# Hand Power

## Introduction

A generator turns mechanical energy into electrical energy, typically using conducting coils rotated in a magnetic field. This is the same way an electric motor works, except in reverse. By turning the crank on our hand crank generators, we can produce electric current in a circuit. This current can be used to power any device, and in this lab, we'll be powering a light bulb to see just how much power we can create.

## Equipment List

Hand-crank-generator
Connecting wires
2 light bulbs and sockets
Ammeter
Voltmeter

## Experimental Procedure

1. Connect a single light bulb to the generator, with the ammeter in series, and the voltmeter across the light bulb socket
    a. Collect the current and voltage measurements in the Vernier software as you turn the crank
    b. Find the average values of current and voltage from the graphs and record below
2. Connect another light bulb in series and repeat the previous measurement steps
   REMEMBER: if you're measuring the voltage drop across one light bulb, you need to calculate the total voltage drop in the circuit!
3. Connect the light bulbs in parallel and repeat the previous measurement steps
   REMEMBER: if you're measuring the current going through only one bulb, you need to calculate the total current in the circuit!

## Results

| Circuit Data | | | |
|---|---|---|---|
| Experiment | Mean Voltage (V) | Mean Current (V) | Power (W) |
| 1 | | | |
| 2 | | | |
| 3 | | | |

## Analysis

1. How do your power measurements for each case compare?

2. What does this imply about the power generation from the hand-crank-generator?

3. How would your power output compare if you turned the crank really fast?

4. How could you use one of these generators in everyday life?

5. The subways' new "high tech" cars put energy lost during braking back into the 3rd rail… This is done by making the train wheels turn one of these types of generators to create power, thus slowing the train down. Calculate how much power can be created by this in one stopping of the train.

   Info: Train Car Mass: 42,070 kg / car
   Number of Cars: 11 (on trains like the A and C)
   Cruise Speed: 40mph (18 m/s)
   Stopping Time: 20 seconds

   Hint: Change in energy per unit time is…POWER