INSTRUCTOR INFORMATION

Generate Power with simpleGEN

Students will build and test an electrical generator and test its generation ability by measuring voltage quantitatively with a digital multimeter and qualitatively using LEDs and light bulbs.

We suggest having some dissected electric motors available for students to observe and handle, since a motor and a generator are essentially the same tool, used in opposite ways.

ESTIMATED TIME

We estimate that the construction of the generator will take most of one class period, especially if students wrap the wire a full 500 turns around. You may want to have additional learning activities available for students who finish early, especially if you have each student or pair of students winding a different number of turns of wire.

NEXT GENERATION SCIENCE STANDARDS

Disciplinary Core Ideas	Crosscutting Concepts	Science and Engineering Practices
Middle School PS2.B: Types of Interactions (MS-PS2) **High School** PS2.B Types of Interactions (HS-PS2) PS3.A: Definitions of Energy (HS-PS3) PS3.C: Relationship Between Energy and Forces (HS-PS3)	Patterns Cause and effect	Analyzing and interpreting data

EQUIPMENT TIPS

1. A video showing construction of the simpleGEN is available at www.vernier.com/kw-sgen.
2. This activity was designed using a digital multimeter such as that included in the simpleGEN kit. It is possible to measure the voltage generated in this activity with a Vernier Differential Voltage Probe or a Vernier Energy Sensor with a data collection interface and software.
3. Assigning each student group constructing a generator a different number of turns of wire will allow the class to examine a variety of results and develop conclusions regarding the effect of the number of turns of wire on the maximum voltage generated. The minimum number of turns of wire is 100 because it is unlikely the LED will light with fewer turns. The maximum number of turns is 500, based on the amount of wire shipped with the simpleGEN kit.
4. If you want a group to use more than 500 turns of wire, your best bet is to purchase a larger spool of 28-guage copper magnet wire. This can be found on Amazon.com, DigiKey.com, AllElectronics.com, or other online retailers. Search for “magnet wire AWG 28.”

You can connect two wires if you thoroughly sand the enamel off the copper on the two ends you want to connect, then twist the wires together and solder them. You may want to add some electrical tape under and over the connection to avoid the rough connection scraping any enamel away from additional turns of wire, which would effectually reduce the number of turns of wire.

5. If you use lights scavenged from strings of holiday decoration lights, check to see if they are incandescent bulbs or LED bulbs. LED bulbs will blink when connected directly to AC power such as generated by the simpleGEN, while incandescent bulbs will have a steadier glow.

DATA COLLECTION AND ANALYSIS TIPS

1. If students do not get a reading from the digital multimeter, make sure they have sanded the ends of the wire so that there is no enamel on the last 2 cm of each wire end.

2. The digital multimeter must be set to measure alternating voltage, as shown in Figure 2.

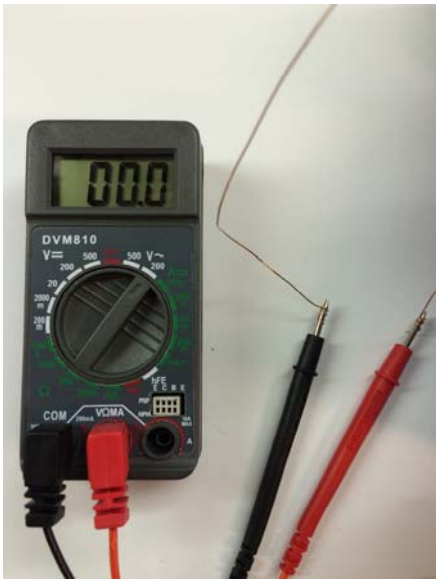

Figure 2

SAMPLE DATA

Total number of turns of wire: 150 Number of magnets in holder: 4

	Spinning shaft by hand	Spinning shaft with drill
Maximum voltage reading	1.85 V	2.31 V
Can you light an LED?	Yes	Yes
Can you light an incandescent bulb?	Yes	Yes
Additional observations	Answers will vary	Answers will vary

ANSWERS TO ANALYSIS QUESTIONS

1. Generators with more turns of wire are able to generate a higher voltage than generators with fewer turns of wire.
2. Answers will vary. Possibilities include increasing the number of turns of wire, using thicker or thinner wire, increasing the number or strength of the magnets, and turning the shaft faster with a better drill. If desired, you can challenge students to improve their generator as an additional activity.