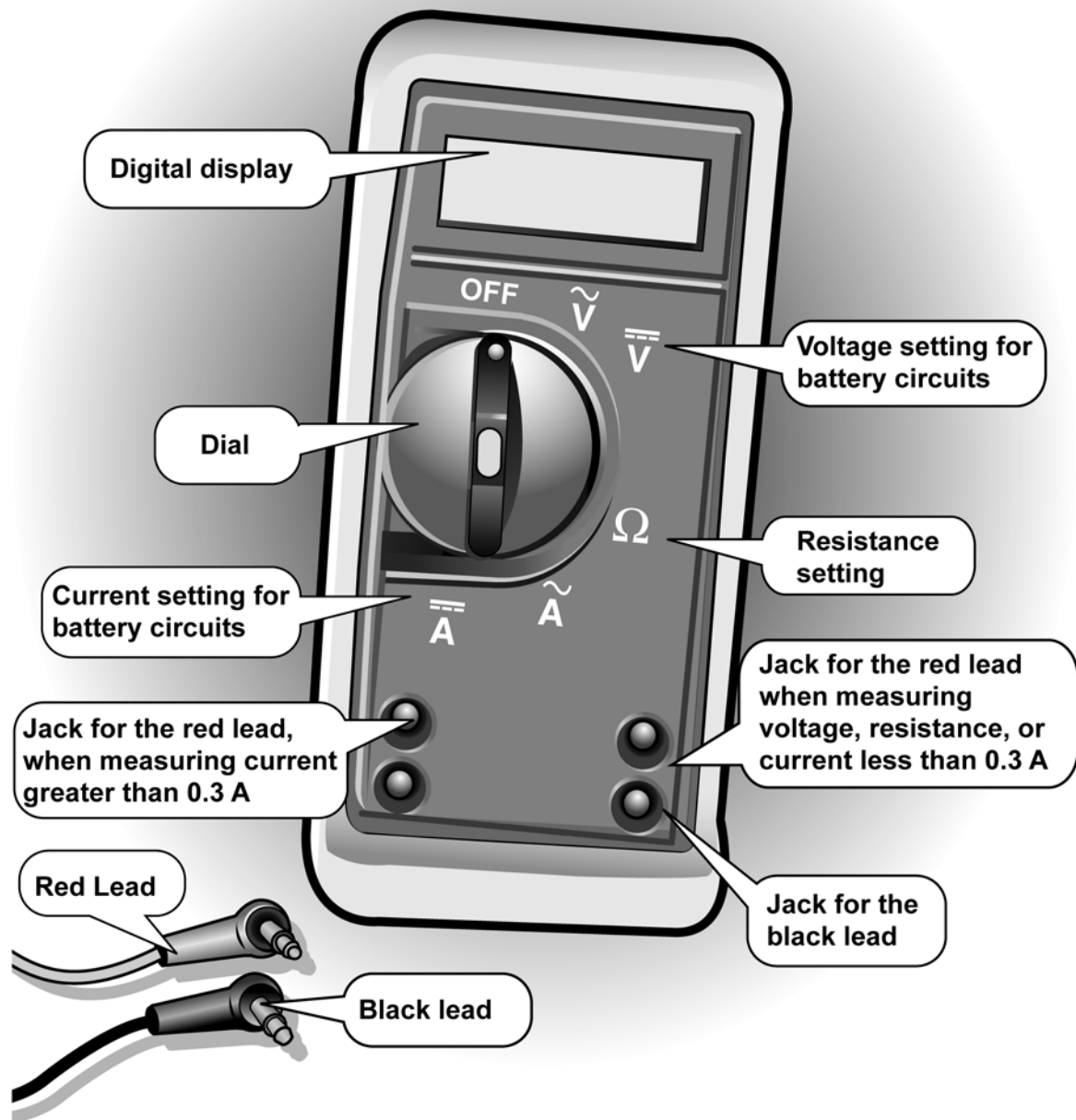


Using an Electric Meter

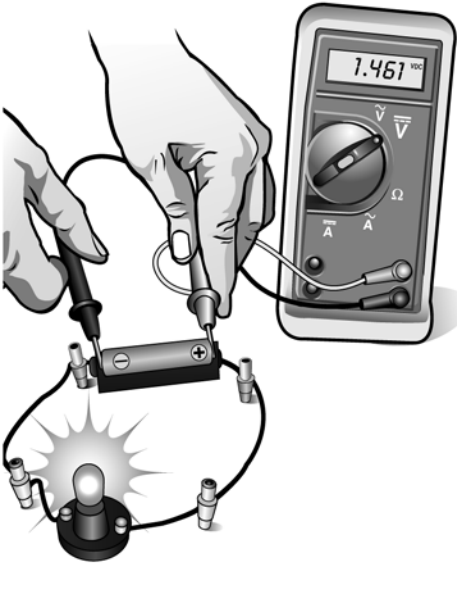
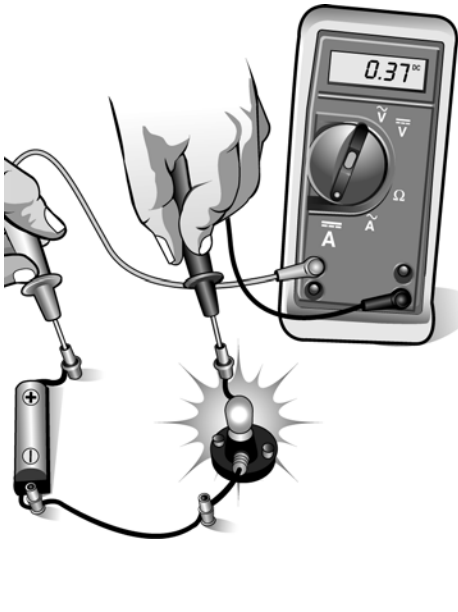
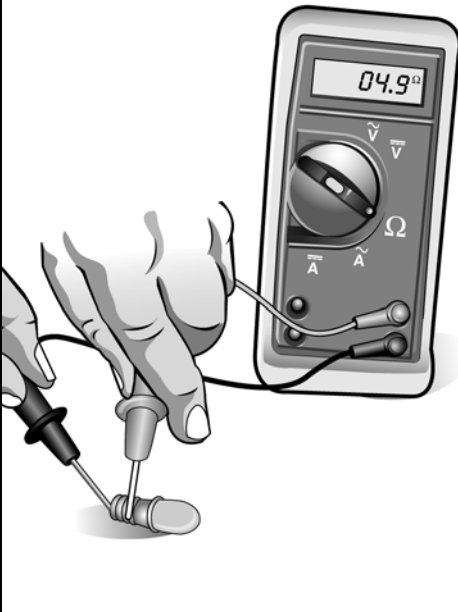


Most people who work with electric circuits use a *digital multimeter* to measure electrical quantities. These measurements help them analyze circuits. Most multimeters measure voltage, current, and resistance. A typical multimeter is shown below:





This table summarizes how to use and interpret any digital meter in a battery circuit. Note: A *component* is any part of a circuit, such as a battery, a bulb, or a wire.

Measuring Voltage	Measuring Current	Measuring Resistance
Circuit is ON	Circuit is ON	Circuit is OFF
Turn meter dial to voltage, labeled V, VDC, or $\overline{\overline{V}}$	Turn meter dial to current, labeled A, ADC, or $\overline{\overline{A}}$	Turn meter dial to resistance, labeled Ω
Connect leads to meter following meter instructions	Connect leads to meter following meter instructions	Connect leads to meter following meter instructions
Place leads at each end of component (leads are ACROSS the component)	Break circuit and place leads on each side of the break (meter is IN the circuit)	Place leads at each end of component (leads are ACROSS the component)
Measurement in VOLTS (V)	Measurement in AMPS (A)	Measurement in OHMS (Ω)
Battery measurement shows relative energy provided Component measurement shows relative energy used by that component	Measurement shows the value of current at the point where meter is placed Current is the flow of charge through the wire	Measurement shows the resistance of the component When the resistance is too high, the display shows OL (overload) or ∞ (infinity)
		

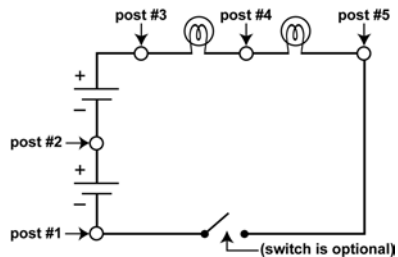
**PRACTICE**

Build a circuit containing 2 batteries and 2 bulbs in which there is only one path for the current to follow. The batteries should be placed so the positive end of one is connected to the negative end of the other. This is called a *series circuit*, and it should form one large loop.

1. Draw a circuit diagram or sketch that shows all the posts in the circuit (posts are where wires and holders connect together).
2. Measure and record the voltage across each battery.
3. Measure and record the voltage across each bulb.
4. Measure and record the total voltage across both batteries.
5. Measure and record the total voltage across both bulbs.
6. How does the total voltage across the bulbs compare to the total voltage across the batteries?
7. Break the circuit at one post. Measure and record the current. Repeat until you have measured the current at every post.
8. How does the current compare at different points in the circuit?
9. Disconnect one of the bulbs from its holder. Measure and record the bulb's resistance. Repeat with the other bulb.
10. Create a set of step-by-step instructions explaining how to use the meter to measure a bulb's resistance, the current through it, and the voltage across it. Find someone unfamiliar with the meter. See if they can follow your instructions.

13.2 Using an Electrical Meter

1. Sample diagram:



2. First battery: 1.553 volts; second battery: 1.557 volts
3. First bulb: 1.514 volts; second bulb: 1.586 volts
4. 3.113 volts
5. 3.108 volts
6. The two voltages are approximately equal.
7. post #1: 0.0980 amps
post #2: 0.0981 amps

post #3: 0.0978 amps
post #4: 0.0980 amps
post #5: 0.0980 amps

8. The current is approximately the same at all points.
9. First bulb: 15.4 ohms; second bulb: 16.2 ohms
10. Measuring resistance: First, set the meter dial to measure resistance. Remove the bulb from its holder. Then place one lead on the side of the metal portion of the light bulb (where the bulb is threaded to fit into the socket). Place the other lead on the “bump” at the base of the light bulb. The meter will display the bulb’s resistance.

Measuring voltage: First, set the meter dial to measure DC voltage. Locate the device (battery, bulb, etc.) that you wish to measure the voltage across. Then place one meter lead on one of the posts next to the device. Put the other meter lead on the post on the other side of the device. The meter will display the device’s voltage. If it shows a negative voltage, switch the two leads.

Measuring current: First, set the meter to measure DC current.

Then break the circuit at the location where you wish to measure the current. Connect one of the meter leads at one side of the break. Connect the other lead at the other side of the break. The meter will display the current. If it shows a negative current, switch the two leads.