Parallel Circuits

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Topic

Parallel circuits

Time

1½ hours

Safety

Adult supervision is required. Please click on the safety icon to view the safety precautions.

Materials

12-V lantern battery
four 12-V lightbulbs
one 24-V lightbulb
four sockets for bulbs
hookup wire
wire cutter
wire stripper
screwdriver appropriate for sockets
ammeter
voltmeter

Procedure

1. Connect three bulbs, as shown in figure 1, to make a parallel circuit.
2. Insert the ammeter in the circuit, as shown in figure 2, to determine the current in the battery. Record this value on the data table.
3. Insert the ammeter in the circuit, as shown in figure 3, to determine the current in the first bulb. Record this value on the data table.

Figure 1

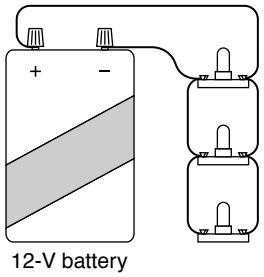


Figure 2

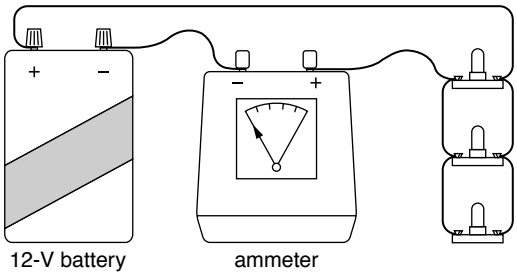
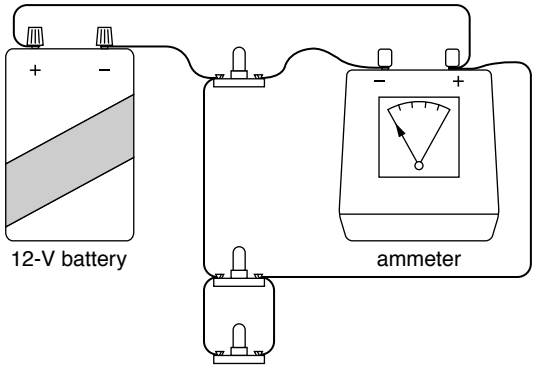


Figure 3



4. Repeat the procedure for the other two bulbs.
5. With a voltmeter, measure the voltage across each bulb and across the battery (figures 4 and 5). Record these values.

Figure 4

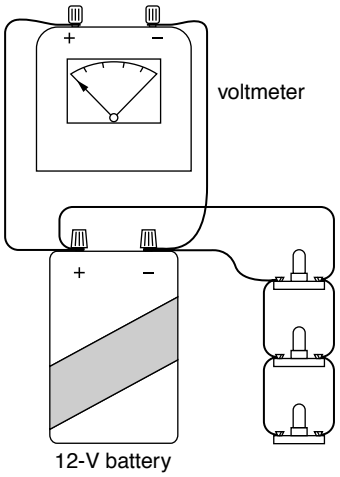
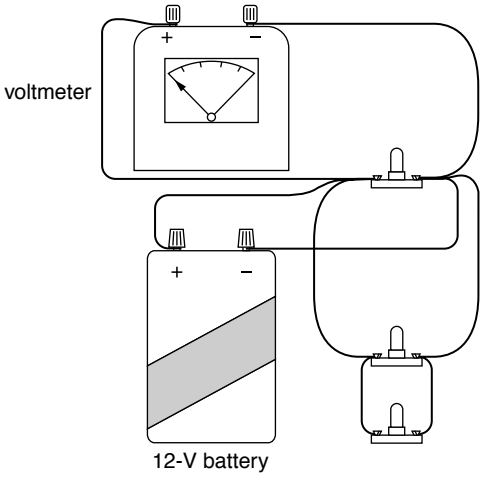


Figure 5



6. Using the values obtained for voltage and current, calculate the resistance and power of each device and of the power supply. Record your results on the data table.

DATA TABLE

Circuits	Current (amps)	Voltage (volts)	Resistance (ohms) (ohms = volts/amps)	Power (watts) (watts = volts 2 amps)
Device 1				
Device 2				
Device 3				
Battery				

7. Add a fourth bulb to the circuit and test the voltage and current. Note your results.
8. Replace one 12-V bulb with the 24-V bulb, and test the voltage and current. Note your results.
9. Compare the current (amperage) through each bulb and the battery. What happened when you replaced a 12-V bulb with a 24-V bulb?
10. Compare the voltage across each bulb with the voltage of the battery. What happened when you added the fourth bulb? What happened when you replaced a 12-V bulb with a 24-V bulb?
11. From your analysis of resistance, what will happen to the light intensity of each lightbulb in the circuit when more lights are added?
12. How does the power supplied by the battery compare with the power used by the three lightbulbs?

What's Going On

Current (amperage) to each bulb is a proportion of the total current in the power supply. Current to each bulb changes when the 24-V bulb is used, but current in all bulbs adds up to the total supplied by the power supply. The voltage remains the same in all branches of the circuit regardless of the number of devices added. Light intensity remains the same. Power used by each bulb is a fraction of the power supplied by the lantern battery. Total power used by the bulbs equals total power supplied by the battery.

Connections

In parallel circuits, devices on the same circuit are independent of each other. Instead of current flowing through one device after another, the current divides and a part of it goes through each. In this demonstration, you discovered some of the properties of parallel circuits.

Safety Precautions

READ AND COPY BEFORE STARTING ANY EXPERIMENT

Experimental science can be dangerous. Events can happen very quickly while you are performing an experiment. Things can spill, break, even catch fire. Basic safety procedures help prevent serious accidents. Be sure to follow additional safety precautions and adult supervision requirements for each experiment. If you are working in a lab or in the field, do not work alone.

This book assumes that you will read the safety precautions that follow, as well as those at the start of each experiment you perform, and that you will *remember* them. These precautions will not always be repeated in the instructions for the procedures. It is up to you to use good judgment and pay attention when performing potentially dangerous procedures. Just because the book does not always say "be careful with hot liquids" or "don't cut yourself with the knife" does not mean that you should be careless when simmering water or stripping an electrical wire. It *does* mean that when you see a special note to be careful, it is extremely important that you pay attention to it. If you ever have a question about whether a procedure or material is dangerous, stop to find out for sure that it is safe before continuing the experiment. To avoid accidents, always pay close attention to your work, take your time, and practice the general safety procedures listed below.

PREPARE

- Clear all surfaces before beginning work.
- Read through the whole experiment before you start.
- Identify hazardous procedures and anticipate dangers.

PROTECT YOURSELF

- Follow all directions step by step; do only one procedure at a time.
- Locate exits, fire blanket and extinguisher, master gas and electricity shut-offs, eyewash, and first-aid kit.
- Make sure that there is adequate ventilation.
- Do not horseplay.
- Wear an apron and goggles.
- Do not wear contact lenses, open shoes, and loose clothing; do not wear your hair loose.
- Keep floor and work space neat, clean, and dry.
- Clean up spills immediately.
- Never eat, drink, or smoke in the laboratory or near the work space.
- Do not taste any substances tested unless expressly permitted to do so by a science teacher in charge.

USE EQUIPMENT WITH CARE

- Set up apparatus far from the edge of the desk.
- Use knives and other sharp or pointed instruments with caution; always cut away from yourself and others.
- Pull plugs, not cords, when inserting and removing electrical plugs.
- Don't use your mouth to pipette; use a suction bulb.
- Clean glassware before and after use.
- Check glassware for scratches, cracks, and sharp edges.
- Clean up broken glassware immediately.

- Do not use reflected sunlight to illuminate your microscope.
- Do not touch metal conductors.
- Use only low-voltage and low-current materials.
- Be careful when using stepstools, chairs, and ladders.

USING CHEMICALS

- Never taste or inhale chemicals.
- Label all bottles and apparatus containing chemicals.
- Read all labels carefully.
- Avoid chemical contact with skin and eyes (wear goggles, apron, and gloves).
- Do not touch chemical solutions.
- Wash hands before and after using solutions.
- Wipe up spills thoroughly.

HEATING INSTRUCTIONS

- Use goggles, apron, and gloves when boiling liquids.
- Keep your face away from test tubes and beakers.
- Never leave heating apparatus unattended.
- Use safety tongs and heat-resistant mittens.
- Turn off hot plates, bunsen burners, and gas when you are done.
- Keep flammable substances away from heat.
- Have a fire extinguisher on hand.

WORKING WITH MICROORGANISMS

- Assume that all microorganisms are infectious; handle them with care.
- Sterilize all equipment being used to handle microorganisms.

GOING ON FIELD TRIPS

- Do not go on a field trip by yourself.
- Tell a responsible adult where you are going, and maintain that route.
- Know the area and its potential hazards, such as poisonous plants, deep water, and rapids.
- Dress for terrain and weather conditions (prepare for exposure to sun as well as to cold).
- Bring along a first-aid kit.
- Do not drink water or eat plants found in the wild.
- Use the buddy system; do not experiment outdoors alone.

FINISHING UP

- Thoroughly clean your work area and glassware.
- Be careful not to return chemicals or contaminated reagents to the wrong containers.
- Don't dispose of materials in the sink unless instructed to do so.
- Wash your hands thoroughly.
- Clean up all residue, and containerize it for proper disposal.
- Dispose of all chemicals according to local, state, and federal laws.

BE SAFETY-CONSCIOUS AT ALL TIMES