

Parallel batteries

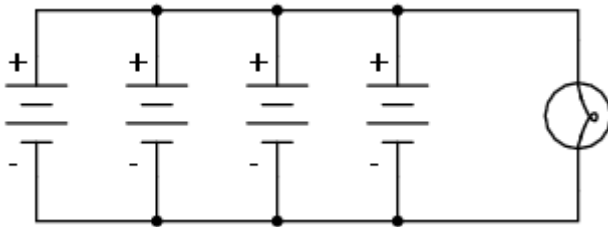
PARTS AND MATERIALS

- Four 6-volt batteries
- 12-volt light bulb, 25 or 50 watt
- Lamp socket

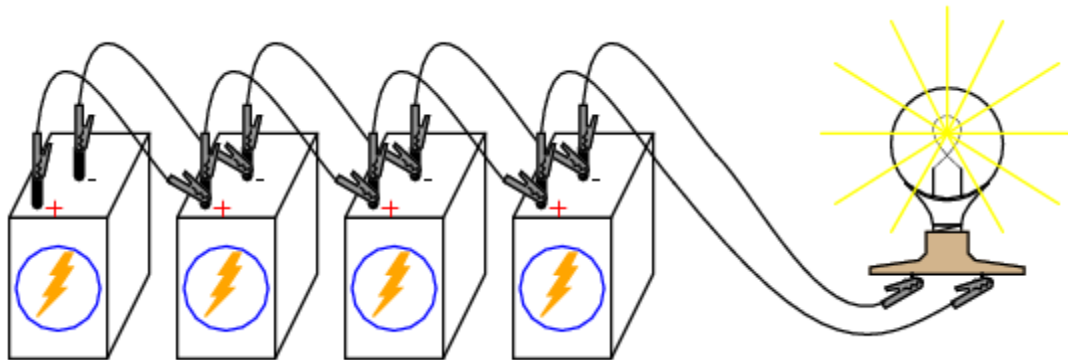
High-wattage 12-volt lamps may be purchased from recreational vehicle (RV) and boating supply stores. Common sizes are 25 watt and 50 watt. This lamp will be used as a "heavy" load for your batteries (*heavy load* = one that draws substantial current).

A regular household (120 volt) lamp socket will work just fine for these low-voltage "RV" lamps.

SCHEMATIC DIAGRAM

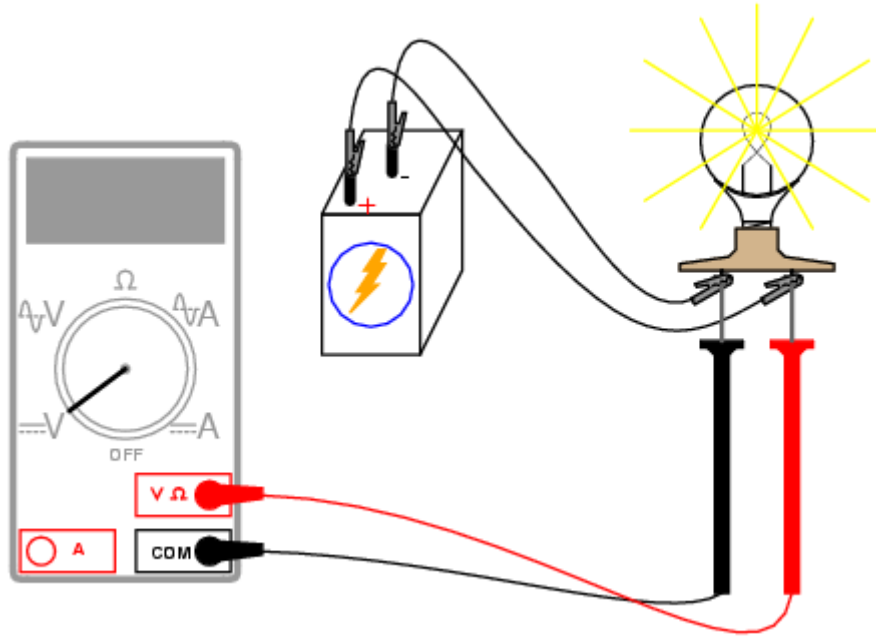


ILLUSTRATION



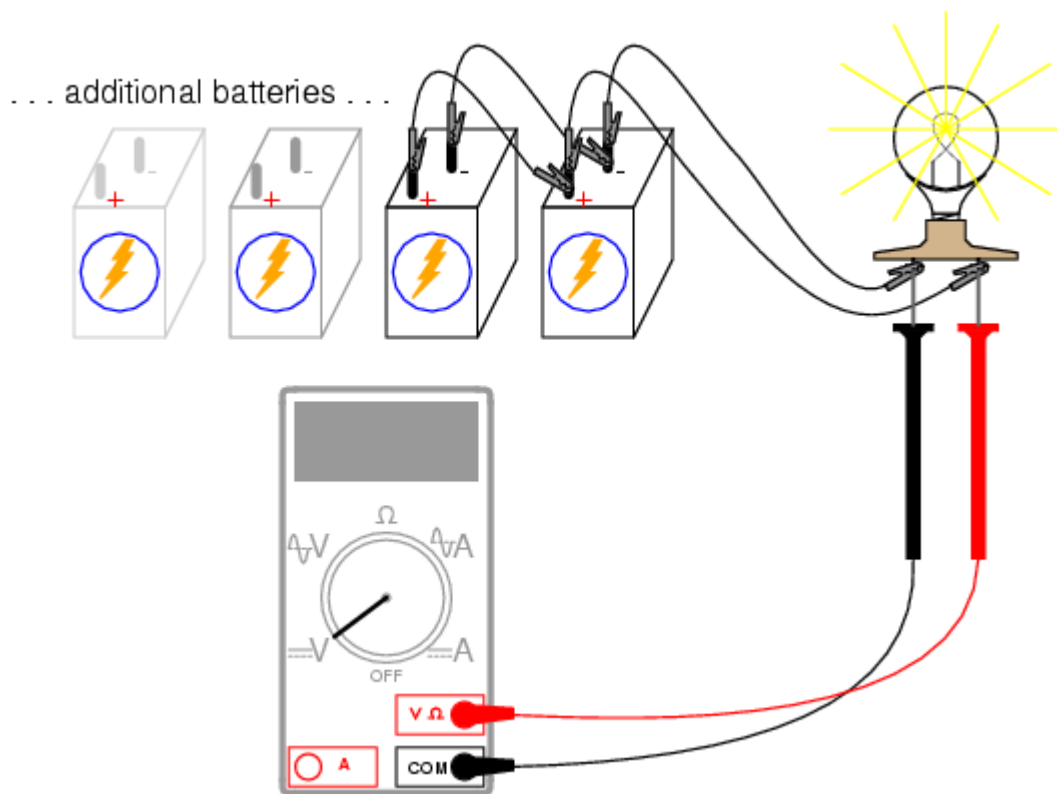
INSTRUCTIONS

Begin this experiment by connecting one 6-volt battery to the lamp. The lamp, designed to operate on 12 volts, should glow dimly when powered by the 6-volt battery. Use your voltmeter to read voltage across the lamp like this:



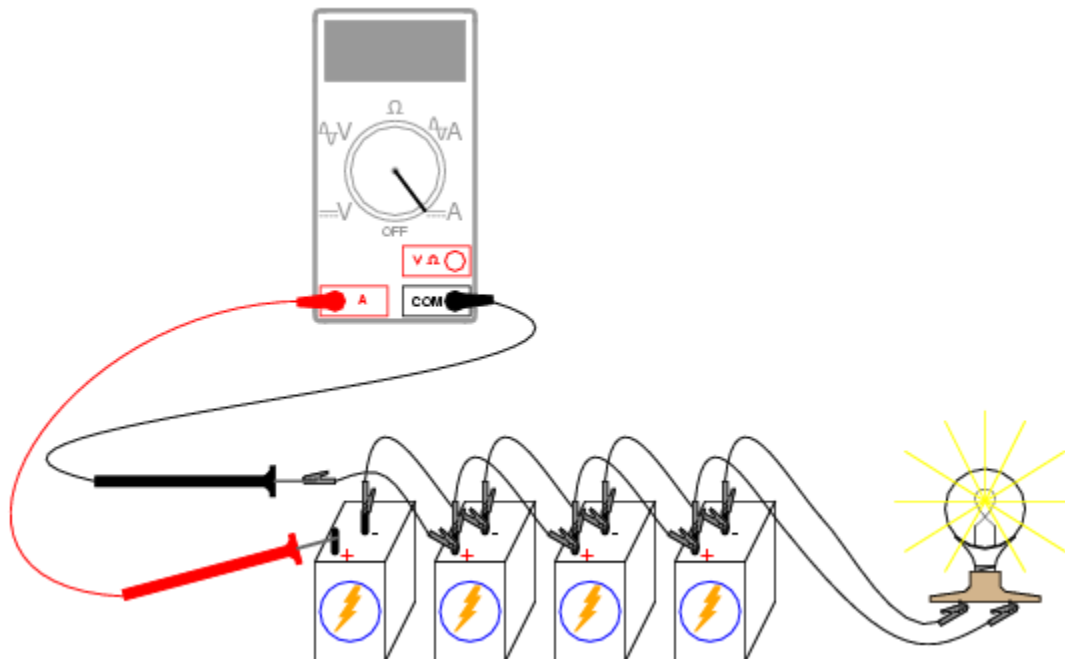
The voltmeter should register a voltage lower than the usual voltage of the battery. If you use your voltmeter to read the voltage directly at the battery terminals, you will measure a low voltage there as well. Why is this? The large current drawn by the high-power lamp causes the voltage at the battery terminals to "sag" or "droop," due to voltage dropped across resistance internal to the battery.

We may overcome this problem by connecting batteries in *parallel* with each other, so that each battery only has to supply a fraction of the total current demanded by the lamp. Parallel connections involve making all the positive (+) battery terminals electrically common to each other by connection through jumper wires, and all negative (-) terminals common to each other as well. Add one battery at a time in parallel, noting the lamp voltage with the addition of each new, parallel-connected battery:

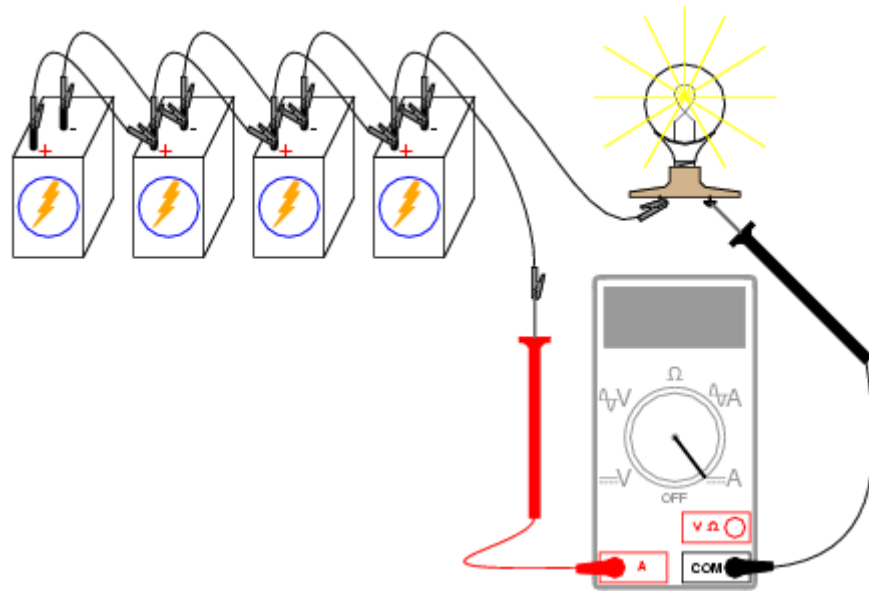


There should also be a noticeable difference in light intensity as the voltage "sag" is improved.

Try measuring the current of one battery and comparing it to the total current (light bulb current). Shown here is the easiest way to measure single-battery current:



By breaking the circuit for just one battery, and inserting our ammeter within that break, we intercept the current of that one battery and are therefore able to measure it. Measuring total current involves a similar procedure: make a break somewhere in the path that total current must take, then insert the ammeter within than break:



Note the difference in current between the single-battery and total measurements.

To obtain maximum brightness from the light bulb, a *series-parallel* connection is required. Two 6-volt batteries connected series-aiding will provide 12 volts. Connecting two of these series-connected battery pairs in parallel improves their current-sourcing ability for minimum voltage sag:

