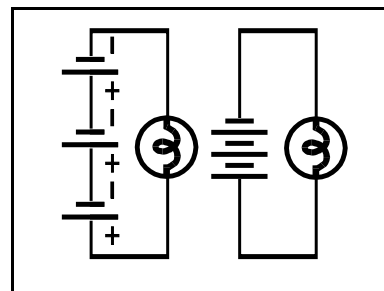


Lesson 4:

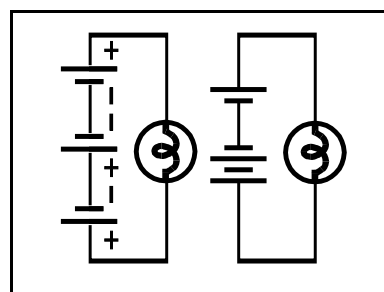
Cells & Batteries Sources in Series and Parallel

Sources Connected in Series

- 1) In the box to the right, draw a schematic diagram of three sources and a light bulb, connected in series
- 2) Connecting sources in series will cause the voltages to increase .
- 3) The voltages add if sources are connected in series
- 4) Sources connected in series will cause the current through a light bulb to increase .
- 5) As more sources are connected in series to a light,
 - A) the brightness of the bulb will increase
 - B) the current will increase
 - C) the voltage across the light will increase
- 6) If one of three sources connected in series to a light, is reversed, the voltage will decrease and the current will decrease . Draw a schematic diagram of this in the box to the right.



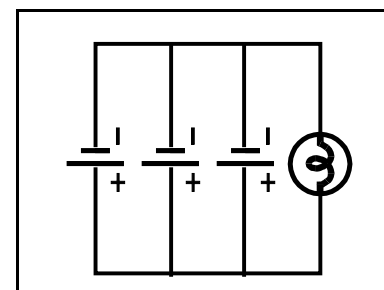
Sources Connected In Series



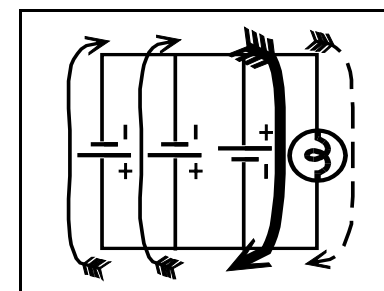
Sources Connected In Series - One Reversed

Sources Connected in Parallel

- 1) In the box to the right, draw a Schematic diagram of three sources and a light bulb, connected in parallel.
- 2) Connecting sources in parallel will cause the voltage to stay the same
- 3) Sources connected in parallel does not change the current through the load.
- 4) The cells in a battery are connected in parallel in order to make each cell last longer
- 5) As more sources are connected in parallel to a light,
 - A) the brightness of the light will stay the same
 - B) the current through each bulb will stay the same
 - C) the voltage across the bulb will stay the same
- 6) If one of THREE sources connected in parallel to a light, is reversed, the voltage across the light will decrease and the current through the light will decrease . The current through the reversed source will increase a lot . Draw a schematic circuit diagram of this.



Sources Connected In Parallel

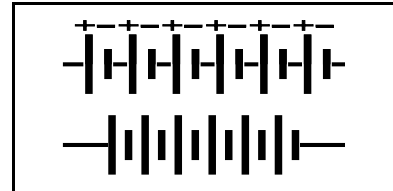


Sources Connected In Parallel - One Reversed

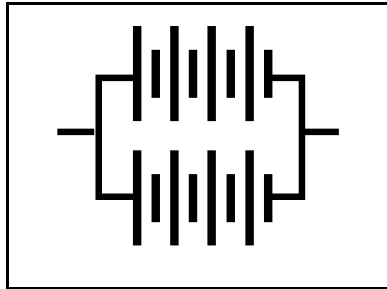
The arrows on the diagram indicate the size of the current (electron flow) This is not a simple situation. The reversed cell acts similar to a short circuit, however it has some internal RESISTANCE (SEE LESSON 5: RESISTANCE - OHM'S LAW PAGE 22). The reversed cell can not carry as much current as a piece of wire

Cells and Batteries

- 1) What is the difference between a cell and a battery? **A battery is made up of a number of cells connected together in series and/or parallel.**
- 2) The cells in a battery are connected in parallel, in order to make each cell last longer.
- 3) Draw a schematic of the cells in a 9 V battery made from 1.5 V cells.



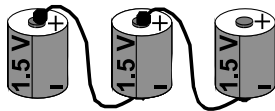
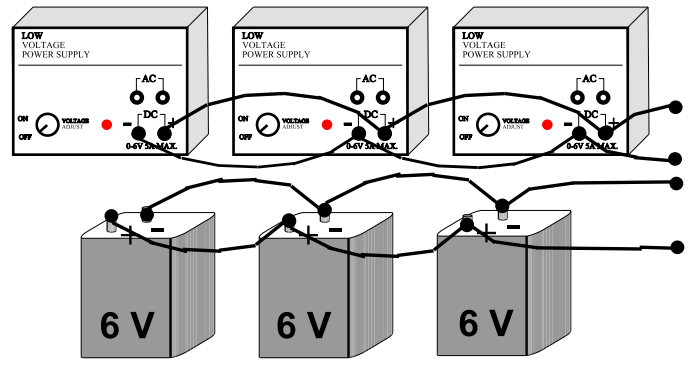
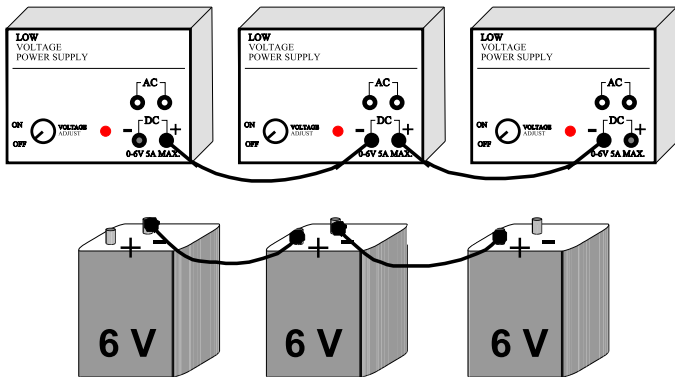
9 Volt Battery



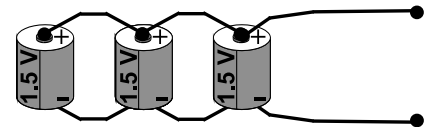
6 Volt Lantern Battery

- 4) Draw a schematic of the cells in a 6 V lantern battery made from 8(eight) - 1.5 V cells.
- 5) The cells of a 6 V lantern battery connected in series in order to increase the voltage
- 6) The cells of a 6 V lantern battery connected in parallel in order to increase cell life

7) Hook up the following sources as indicated

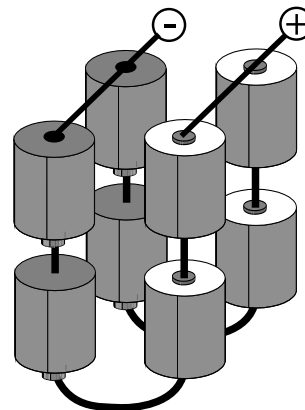
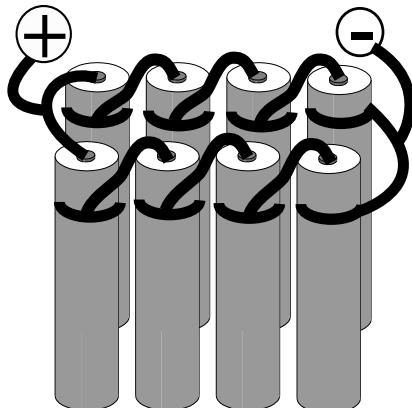


SERIES

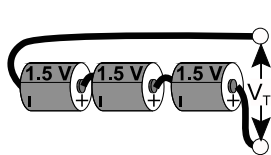


PARALLEL

8) Hook up the following cells of a 6 V lantern battery . Show where the exterior terminals would be.

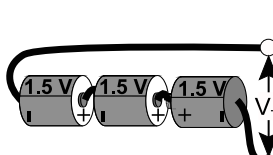


9) State whether the following sources are a SERIES OR PARALLEL connection and indicate the TOTAL VOLTAGE.



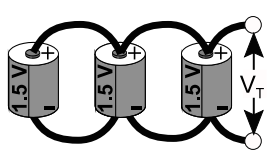
Series Circuit

$V_T = 4.5 \text{ V}$



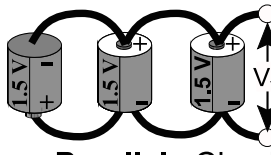
Series Circuit

$V_T = 1.5 \text{ V}$



Parallel Circuit

$V_T = 1.5 \text{ V}$



Parallel Circuit

$V_T = \text{less than } 1.5 \text{ V}$

Research the five different sources of electric voltage. These are the only ways that have been found to push electrons around a circuit.

OTHER TYPES OF SOURCES		
Energy Form Involved	SOURCE Device Converting Other Forms Of Energy Into Electrical Energy	LOAD Device Converting Electrical Energy Into Other Forms Of Energy
Magnetic (with mechanical movement)	Generators	Motors
Chemical	Wet and "Dry" cells	Secondary or Rechargeable Cells
Light	Solar (photo) cell	Light Emitting Diode (LED)
Heat	Thermocouple	Resistor
Mechanical Distortion of Crystal Lattice	Piezoelectric Crystal	Piezoelectric Buzzer or timing chip