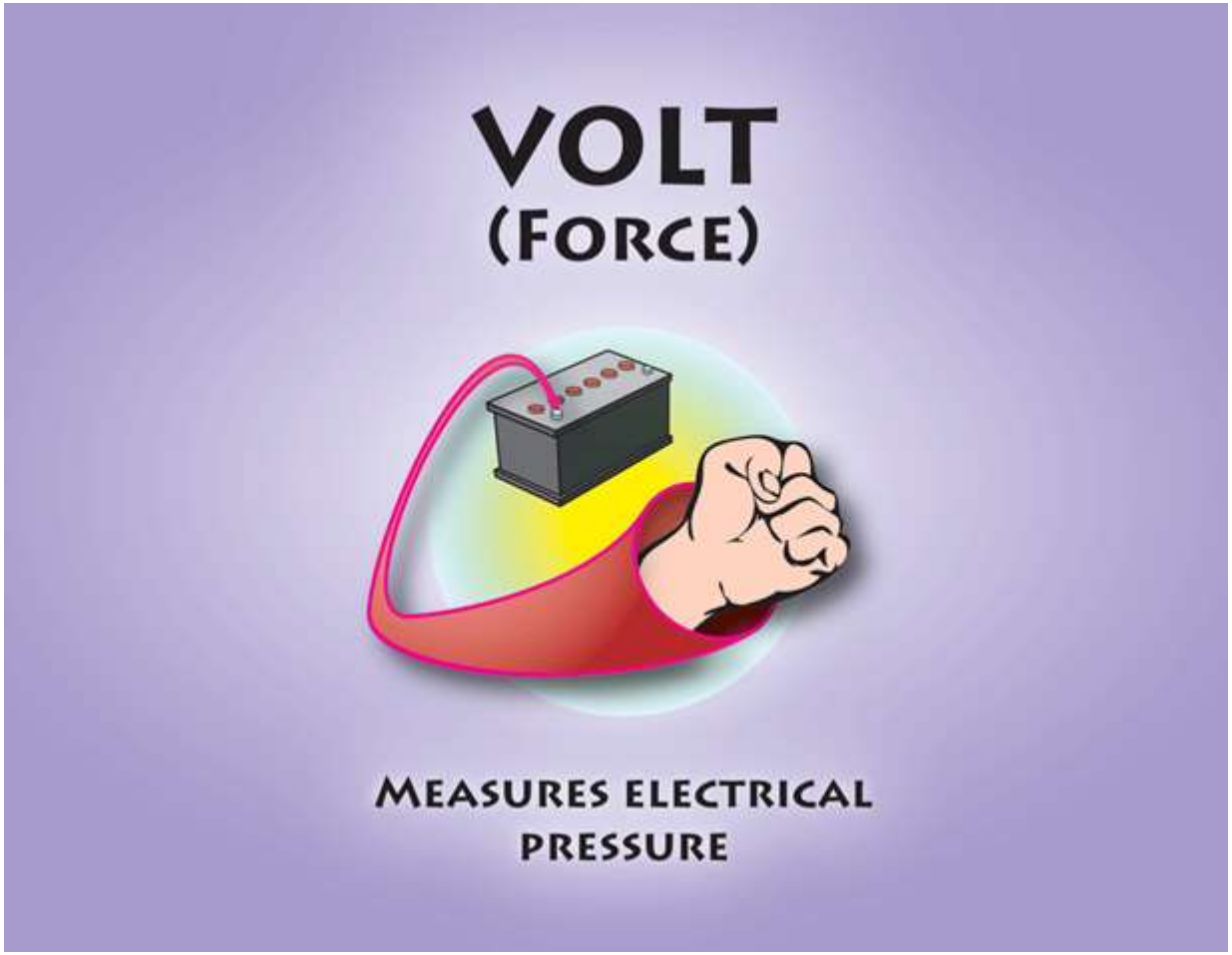
# BASIC ELECTRICITY for PVs

Part One:  Volts, Amps, Watts

Series and Parallel Wiring

# Volts, Amps, Watts

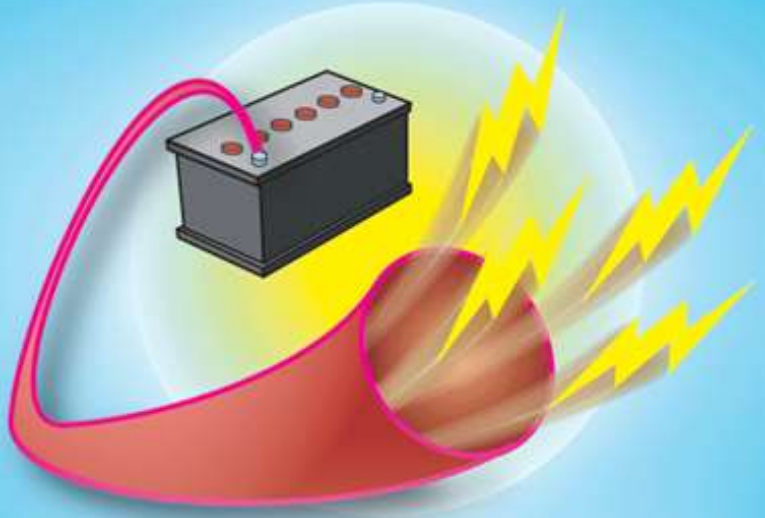


# VOLTS

- Difference causes “force”
- Electromotive Force
- Water Analogy:  “Pressure”

# High Volts or Low Volts?

# AMPERE
## (CURRENT)



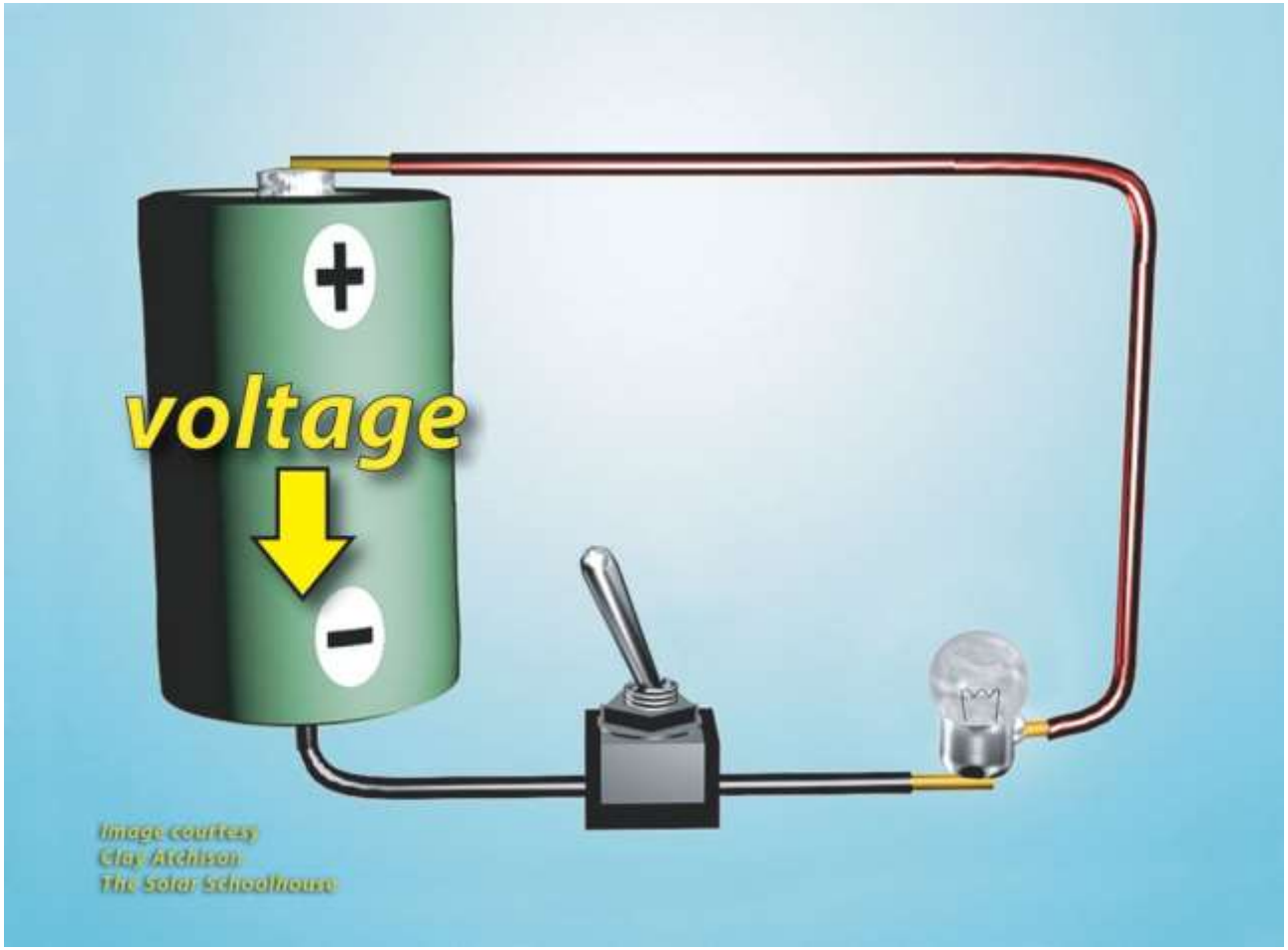
MEASURES THE NUMBER
OF MOVING ELECTRONS
(OR ELECTRIC CHARGES)

Courtesy Clay Atcheson

# AMPS

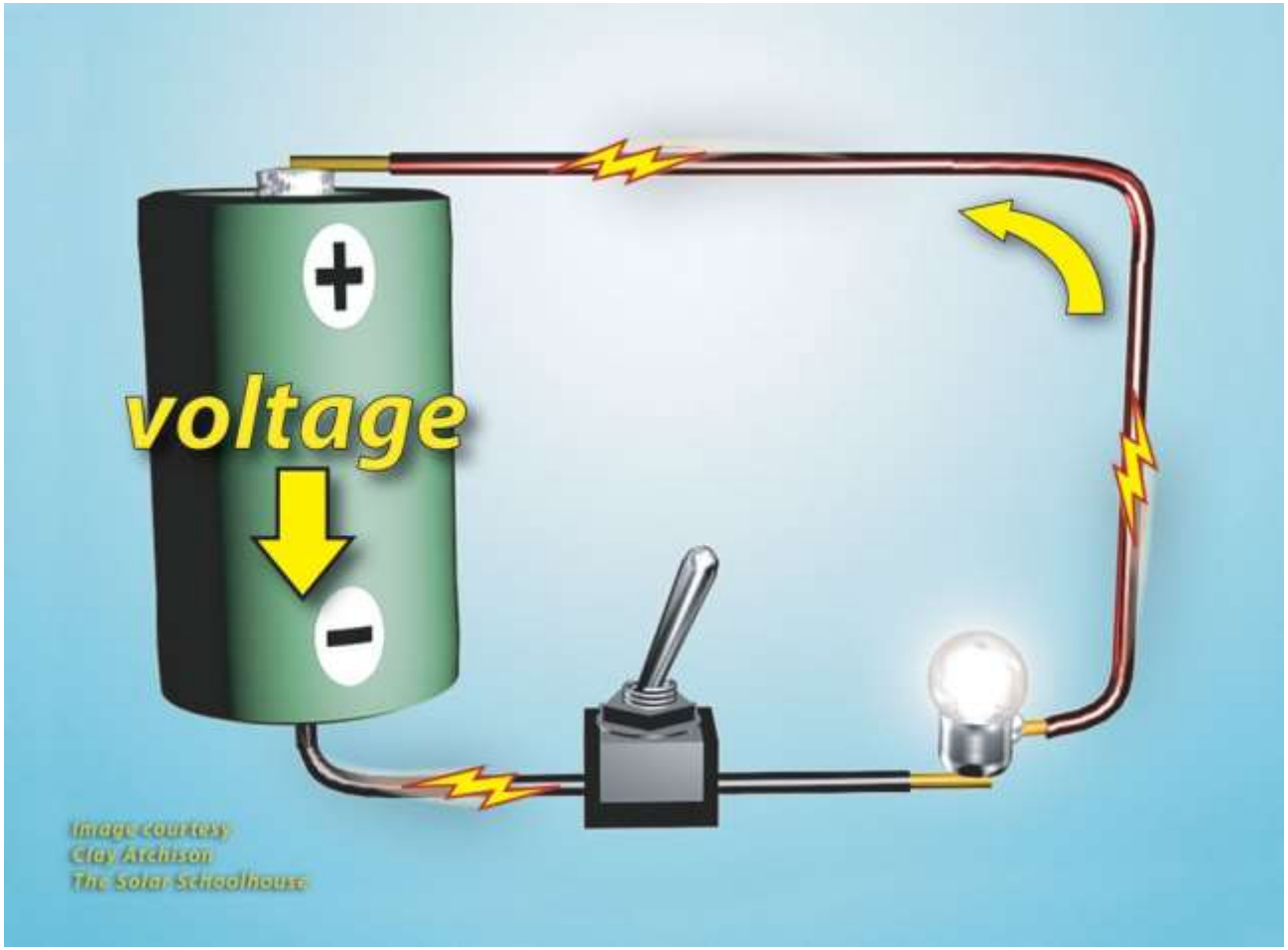
- Current, Flow of Electrical Charges
- Only measurable when circuit is closed (on)
- Water Analogy:  GPM, volume

# Can we measure Amps?
# Can we measure Volts?



# Can we measure Amps now?

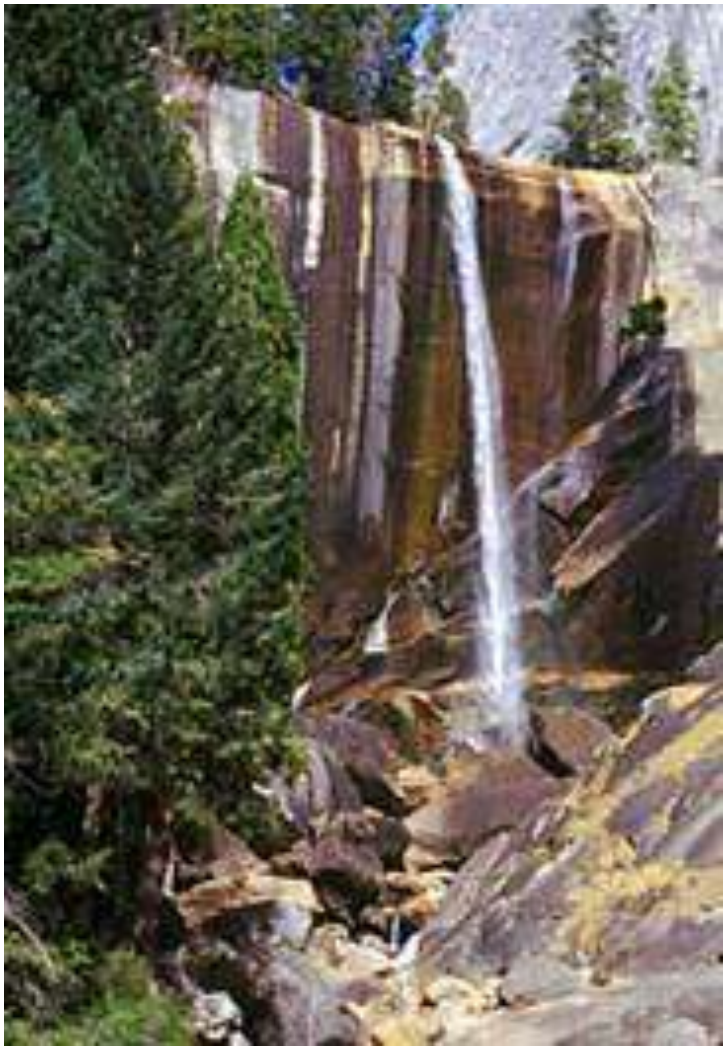
## How about Volts? How would you measure it?



# Demonstration
# Volts and Amps

# Describe this River in terms of Volts and Amps

# Compare this same Waterfall in two different seasons in terms of Volts and Amps



# Watts is the Product of Volts and Amps

Volts x Amps = Watts

12 volts x 5 amps = 60 watts

# Watts is the Product of Volts and Amps

Volts x Amps = Watts

Typical light bulb is 60 watts

120 volts x 0.5 amps = 60 watts

12 volts x 5 amps = 60 watts

# PRACTICE

- Write Definitions for Volts, Amps, Watts. Include the Water analogy
- Solve the Power Formula Equations on the White board
- Share (and check) your answers with neighbor

# Practice Using Power Formulas

- 2 volts x 2 amps = _____watts
- 4 volts x 2 amps = _____watts
- 12 volts x 2 amps = _____watts
- 12 volts x 10 amps = _____watts
- 24 volts x 20 amps = _____watts
- 500 volts x 10 amps = _____watts

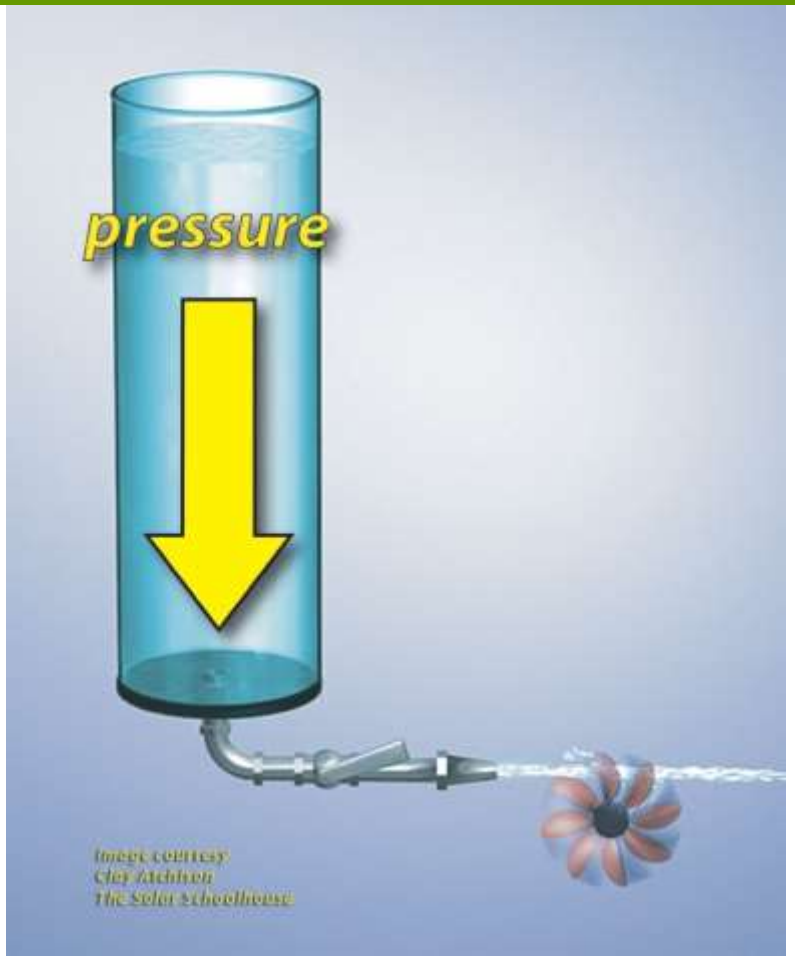
# The PhotoVoltaic Effect: DeBrief

- First:  Write in Journals:
- Second: Discussion
- Energy Transformation:  Light→Electricty

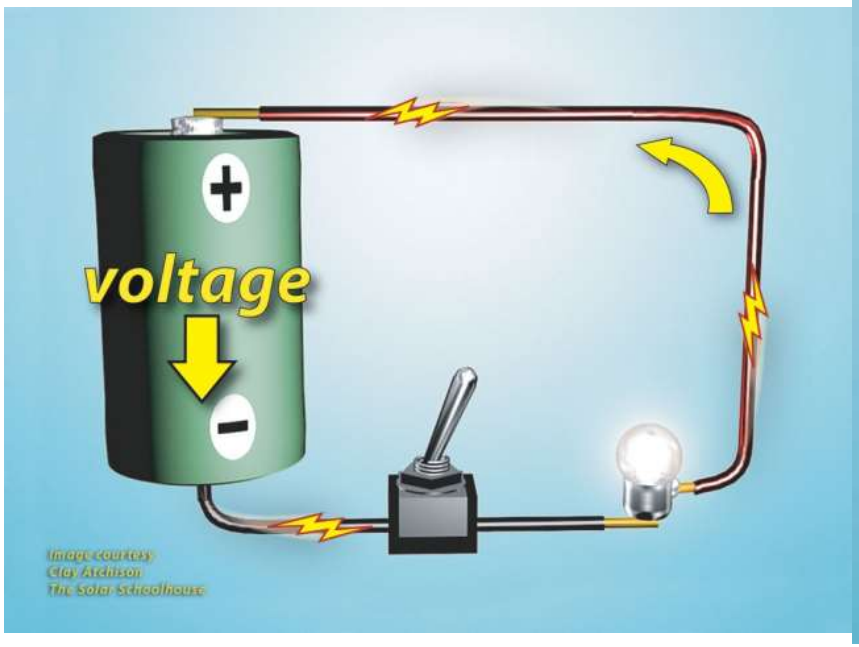
Discuss their explorations: shade, orientation, reflection, concentration

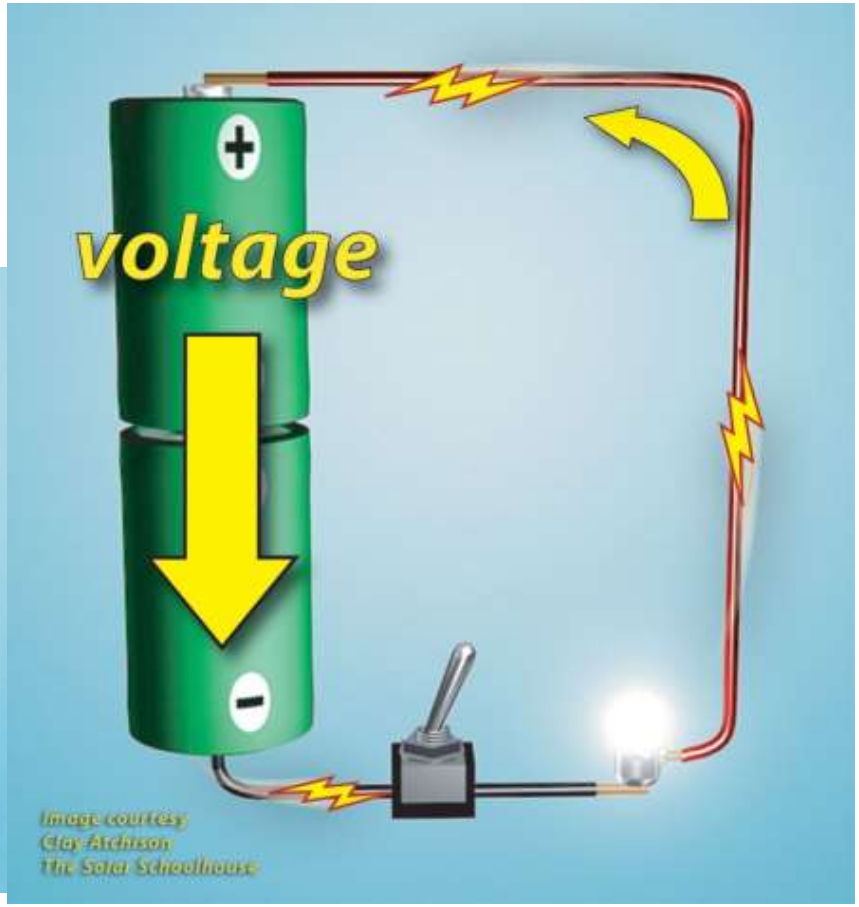
# Pressure of One Cylinder of Water

# Double the height of the cylinder…

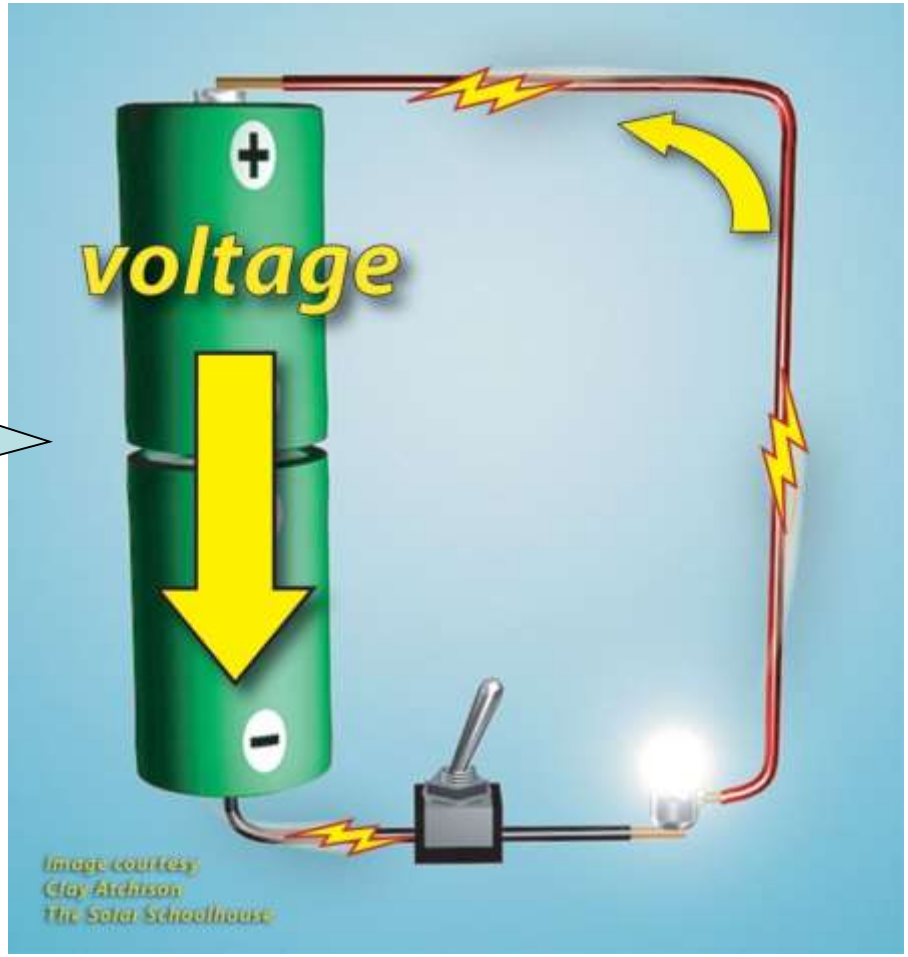
# In similar fashion when we double the battery in series (pos to neg)



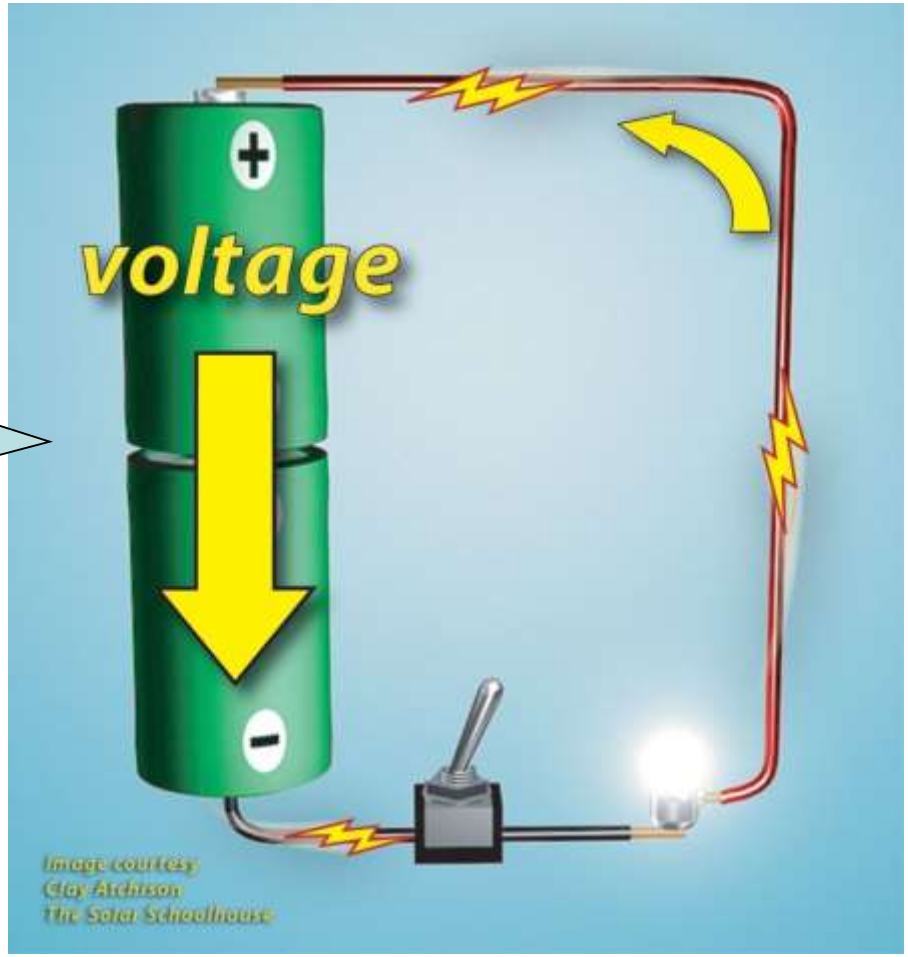
In series wiring we wire the positive of one of the power sources to the negative terminal of the other power source. E.g. two batteries into a flashlight

1.5 volts
+
1.5 volts
= 3 volts

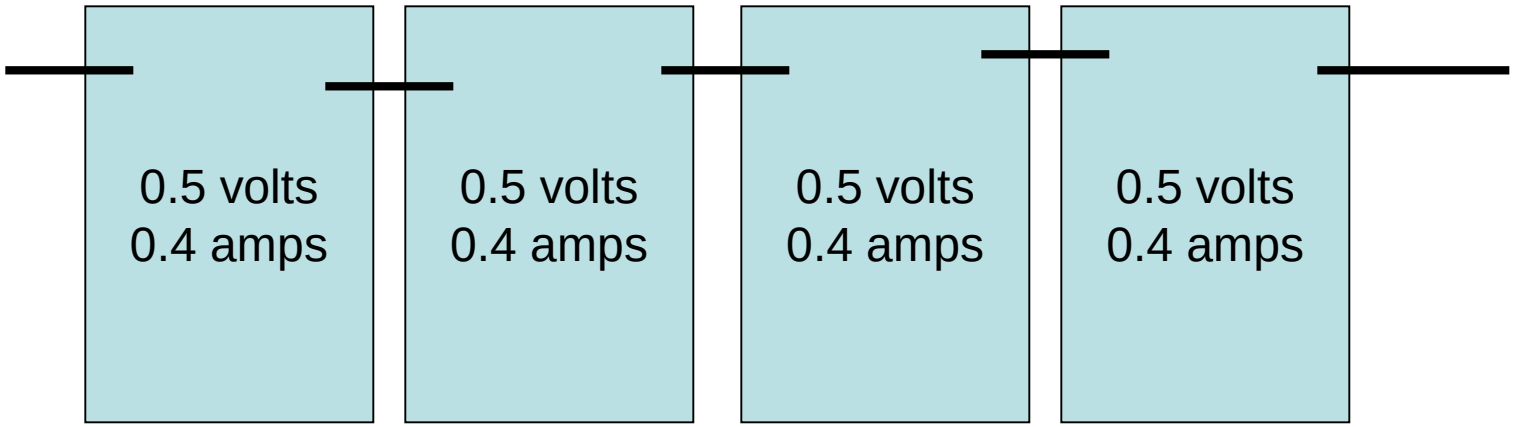


# In series wiring Volts add up and amps stay constant

1.5 volts
+
1.5 volts
= 3 volts

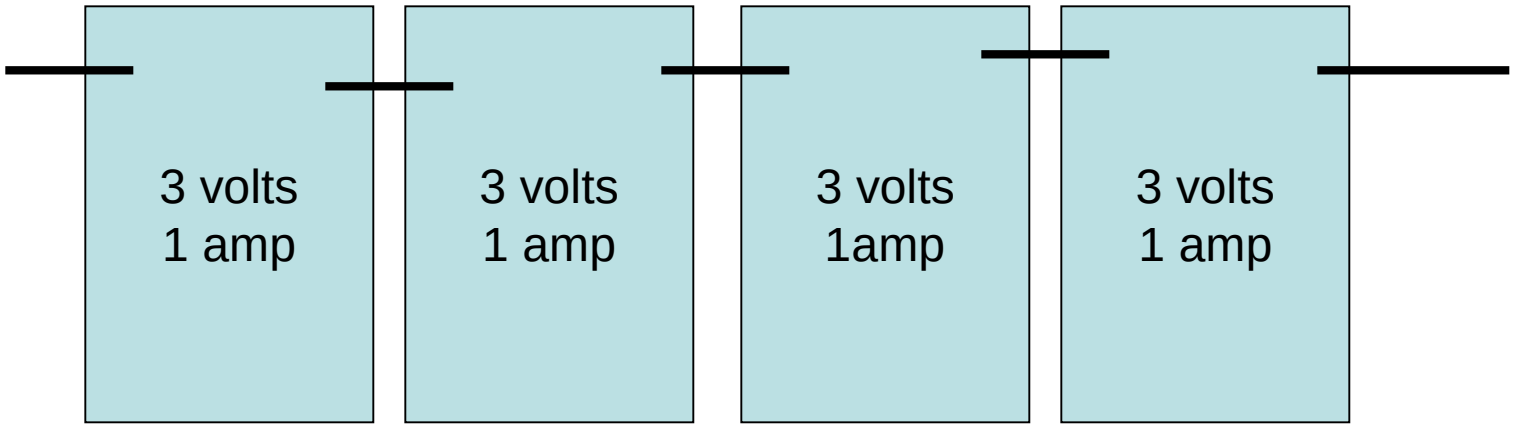


# The same holds true for wiring Solar Modules in Series




Four 0.5 volt modules in series will produce
4 x 0.5 volts = 2 volts
The amperage will stay the same

# The same holds true for wiring Solar Modules in Series



# Parallel Wiring

- In parallel wiring, we connect the positive lead of one source to the positive lead of a second power source.  In parallel wiring, the voltage stays the same, but the amps add up.

# Wiring Solar Modules in Parallel and Parallel