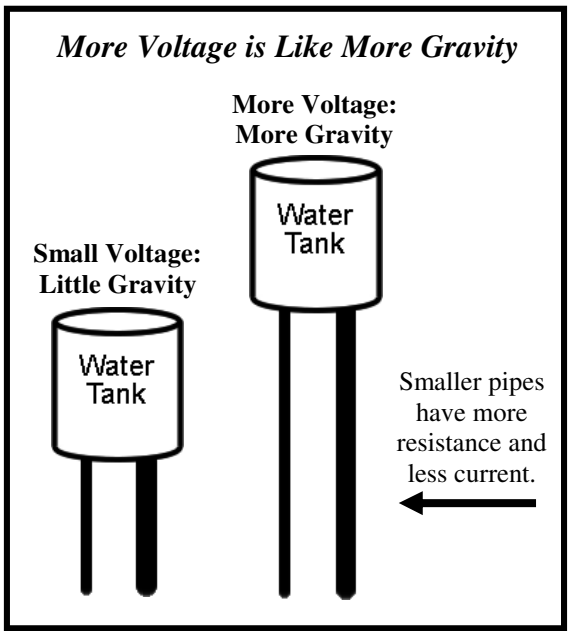
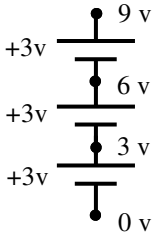
Voltage In a Circuit

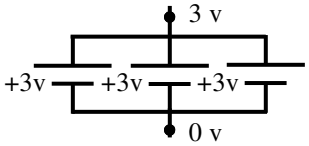
Batteries add voltage: as you move over a battery you gain voltage. The voltage at the bottom of the first battery is always 0 volts. *Think of batteries as lifting water up: adding electrical potential energy.*



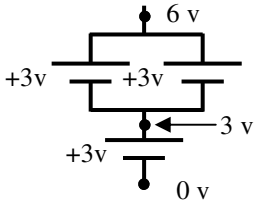
Batteries in series add voltage (raising electrical potential energy).



Batteries in parallel share the same voltage. (They just last longer.)

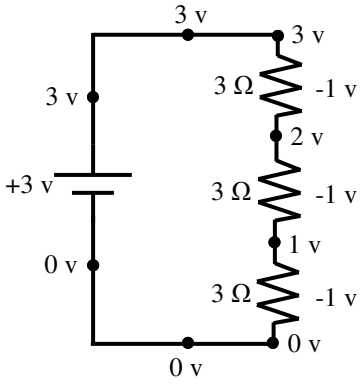


Remember: there can never be a change of voltage on a wire.

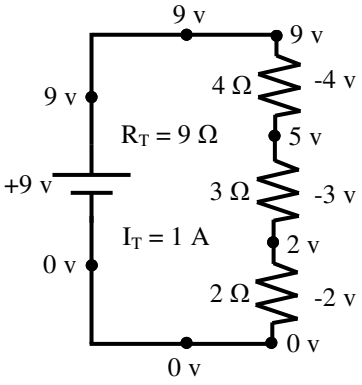


Notice here that the two batteries in parallel add only 3 volts, giving 6 volts total.

Resistors use (subtract) voltage: Every resistor in a circuit uses voltage. Think of it as a negative voltage: subtract the voltage it uses from the voltage at the top of the resistor. Resistors in series SHARE voltage, with bigger resistors using more of the available voltage. *Think of resistors as lowering water down: decreasing electrical potential energy.*



In this circuit we don't need to calculate the voltage drops. Since there are three resistors of equal resistance, each will use one-third the available resistance.



To find the voltage drops, we must first find the total current.

$$I_T = \frac{V_T}{R_T} = \frac{9v}{9\Omega} = 1A$$

$V_{4\Omega} = IR = 1(4) = 4v$

$V_{3\Omega} = 3v$

$V_{2\Omega} = 2\ v$

Notice that the biggest resistor used the most voltage.

Each battery raises voltage (the electrical potential energy) and each resistor uses part of the voltage (lowering the electrical potential). Since the three resistors are in series, they have the same current (since there is only one path for the current).

V = IR, so I = V/R
R_{total} = 6 Ω and V_{total} = 3 v
So, I = 3v/6Ω = 0.5 amps.

Then use V = IR for each resistor to find how much voltage it uses.