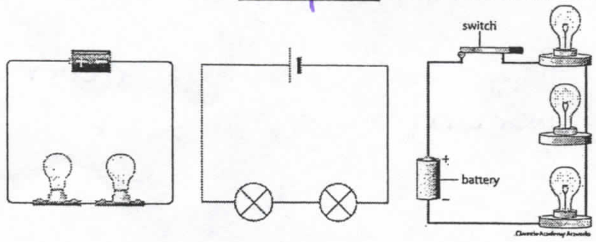
Ms. Murnaghan

Erin Lau

Series and Parallel Circuits

- Series Circuit = a circuit that has only one path for current!
- If the switch opens, then all the electrons stop their movement and the current Stops.



Simple circuit

Voltage in Series

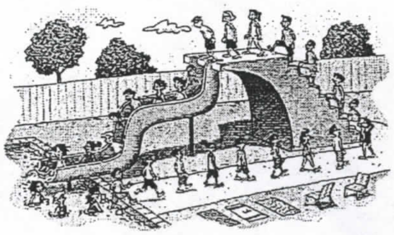


Figure 9.3 Everyone who uses this slide follows the same path.

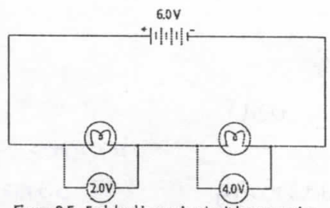
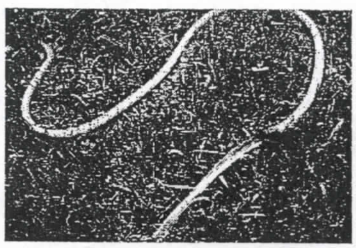


Figure 9.5 Each load in a series circuit loses a portion of the total voltage.

- People represent the electrons, at the top of the slide they have more energy than at the bottom.
- As they slide, they "lose"/use ALL the energy of the 12 steps before returning the bottom of the stairs.
- A cell/battery that has 12V (energy) will loose it all as it travels around the circuit. Vt = V1 + V2 + V3……
- 6.0V = 2.0V + 4.0V
  - voltage lost through the loads equal the voltage of the cell / battery

Current in Series



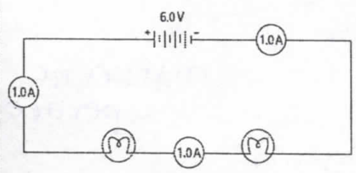
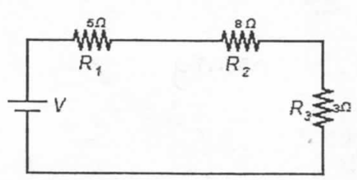


Figure 9.6 The current is the same throughout a series circuit.

$I_t = I_1 = I_2 = I_3$

- All the electrons repel each other with the same force.
- Since there is one path for the electrons to follow the current with stay the same.
- The rate that the electrons travel in the beginning will be the same at the end, like the garden hose.

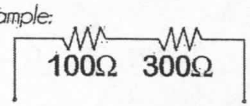
Resistors in Series



Resistors in series

$R_{eq} = R_1 + R_2 + \ldots R_n$

Example:



$= 100\Omega + 300\Omega$

$= \boxed{400\Omega}$

- Since electrons only have one path to follow, they must really slow down at the load point.
- This will affect how fast the electrons can pass through the entire circuit. (it would take longer)
- If you put resistors in series, you increase the resistance of the entire circuit.

Parallel Circuits

- Parallel circuits = a circuit with several different pathways for electrons and current to travel through
- Electrons that leave the cell/battery have ~~a~~ many pathways to choose from to get back to the cell/battery
- If the electrons are flowing down one pathway the other pathways will still operate and the circuit will still be working.

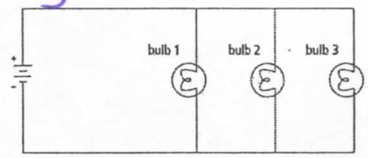
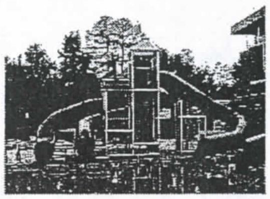


Figure 9.7 Electrons leaving the battery have three possible ways to return to the battery in this circuit.

Voltage in Parallel

- All the kids/electrons will slide down a slide (loose all the energy) but can take different slides.
- No matter which way the electron decides to take, it still has to "lose"/ use all 12V of it's energy.
- This is why each pathway has the same voltage reading.

$V_t = V_1 = V_2 = V_3$



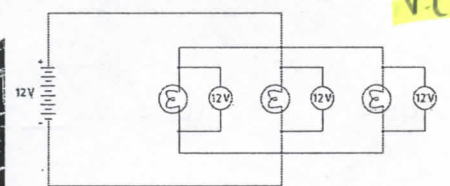


Figure 9.9 Each load in parallel must have the same voltage.

Current in Parallel

- Different pathways to take will allow some electrons to travel faster and some to travel slower, depending on how those pathways are organized.
- This means the current can be different on all the pathways.
- The current where the path seperates must equal the same amount at the point where the current rejoins.
- The sum of the pathways must equal the junction where it leaves

$I_t = I_1 + I_2 + I_3$

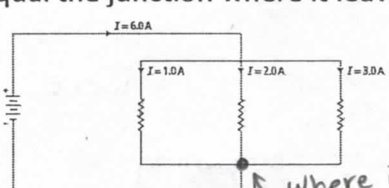
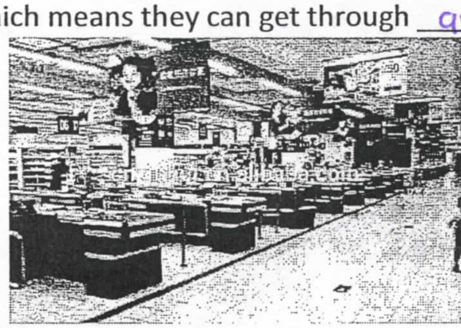


Figure 9.10 Current entering the junction point divides among the three possible paths.

$V = IR$

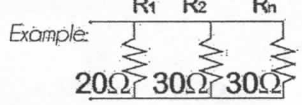
Resistors in Parallel

- Resistors placed in parallel will decrease the total resistance of the circuit because there are multiple pathways.
- Even though they must pass through a resistor, not as many electrons take the same path which means they can get through quicker.



$$R_{eq} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \dots \frac{1}{R_n}}$$

Example:



$$\frac{1}{\frac{1}{20\Omega} + \frac{1}{30\Omega} + \frac{1}{30\Omega}} = \boxed{8.57\Omega}$$