Parallel Circuits

PSI Physics

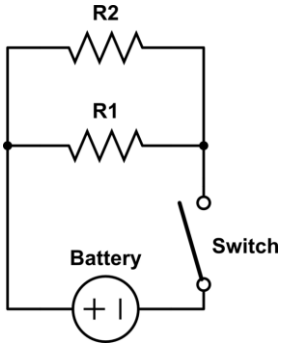
Name_____ Date:_____ Period:_____

Objectives:

- Measure and calculate voltage drops across any part of a parallel circuit
- Measure and calculate the current through any part of a parallel circuit
- Find the equivalent resistance for a parallel circuit

Materials:

- Battery (Power Source)
- Connecting wires
- Two resistors
- Knife switch
- Ammeter
- Voltmeter

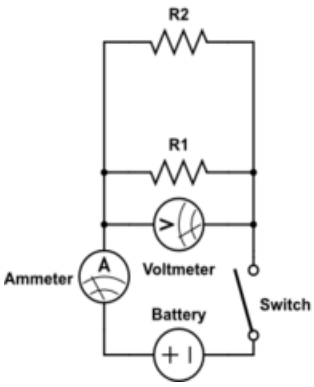


Parallel Circuits

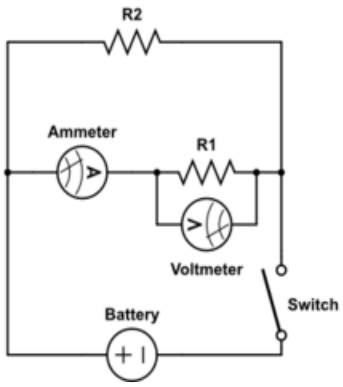
Parallel circuits are circuits where all the resistors are along different paths or branches; no two resistors are on the same branch. (right)

Procedure: For each of circuits 1, 2 and 3 below:

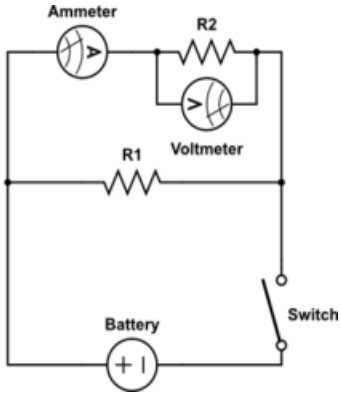
Circuit 1



Circuit 2



Circuit 3



1. Construct the circuit. Make sure that the ammeter is in line with the resistors, and that the voltmeter is connected as shown.
2. Record the current and voltage drops.

Data Collection:

Circuit 1		Circuit 2		Circuit 3	
I	V	I_1	V_1	I_2	V_2

Analysis:

Use Ohm's Law to calculate the resistance for each circuit.

Resistances		
Circuit 1	Circuit 2	Circuit 3
$\mathrm{R}_{\mathrm{equivalent}} = \frac{V}{I}$	$\mathrm{R}_1 = \frac{V_1}{I_1}$	$\mathrm{R}_2 = \frac{V_2}{I_2}$

Use the information in the Data Collection and Analysis Tables to answer the following questions:

1. How is the voltage, V, related to the other two voltage drops, V_1 and V_2? Write an equation that describes the relationship.

2. How is the current, I, related to the other two currents, I_1 and I_2? Write an equation that describes the relationship.

3. Which of the resistances R_1, R_2, and $R_{equivalent}$ is smallest?

4. The equivalent resistance, $R_{equivalent}$, for resistances in parallel is:

$$\frac{1}{R_{equivalent}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots \textit{up to the total number of resistors in parallel}$$

   a. Using the values of R_1 and R_2 in your analysis table, calculate $R_{equivalent}$. How does this compare with the value you got from dividing V by I in the Analysis Table?

   b. Is there a way to make $R_{equivalent}$ bigger than R_1 or R_2? If not, why not? Or if so, how?

5. A 9V battery is connected to two resistors in parallel (R_1 = 10 Ω and R_2 = 15 Ω).
    a. What is the equivalent resistance, $R_{equivalent}$, for the circuit? (use the boxed equation on the previous page)

    b. What is the current, I, through the circuit? (use V = IR)

    c. What is the voltage drop, V_1, across resistor R_1? (use V = IR)

6. If you add a third resistor in parallel with the other two…
    a. Will $R_{equivalent}$, increase, decrease or stay the same? Why?

    b. Does the current, I, increase, decrease or stay the same? Why?

    c. Does the voltage drop, V_1, across R_1 increase, decrease or stay the same? Why?