**CS373-1 LAB #1 – Fundamentals of Electric Circuits**

## MY NAME: Joseph, Derek, Kat, Riley, Scott DUE: Sep 16 Received: .

**GRADE:**

|  |  |  |
| --- | --- | --- |
| **CATEGORY** | **POINTS** |  |
| **Exercise 1** |  | 10 |
| **Exercise 2** |  | 10 |
| **Exercise 3** |  | 10 |
| **Exercise 4** |  | 10 |
| **Exercise 5** |  | 10 |

|  |  |  |
| --- | --- | --- |
| **CATEGORY** | **POINTS** |  |
| **Exercise 6** |  | 10 |
| **Exercise 7** |  | 10 |
| **Exercise 8** |  | 10 |
| **Exercise 9** |  | 10 |
| **Exercise 10** |  | 10 |
| **TOTAL** |  |  |

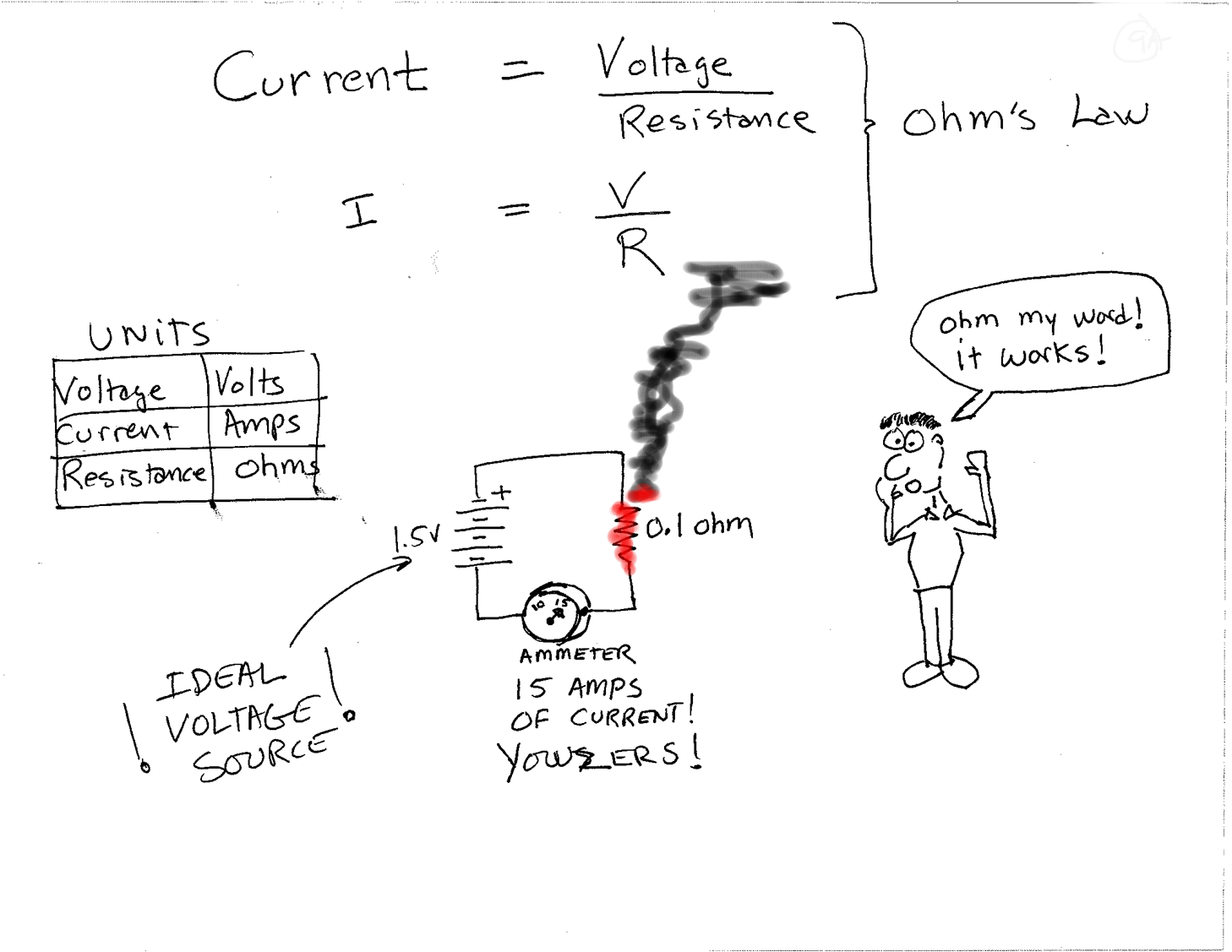
## Goals for Today

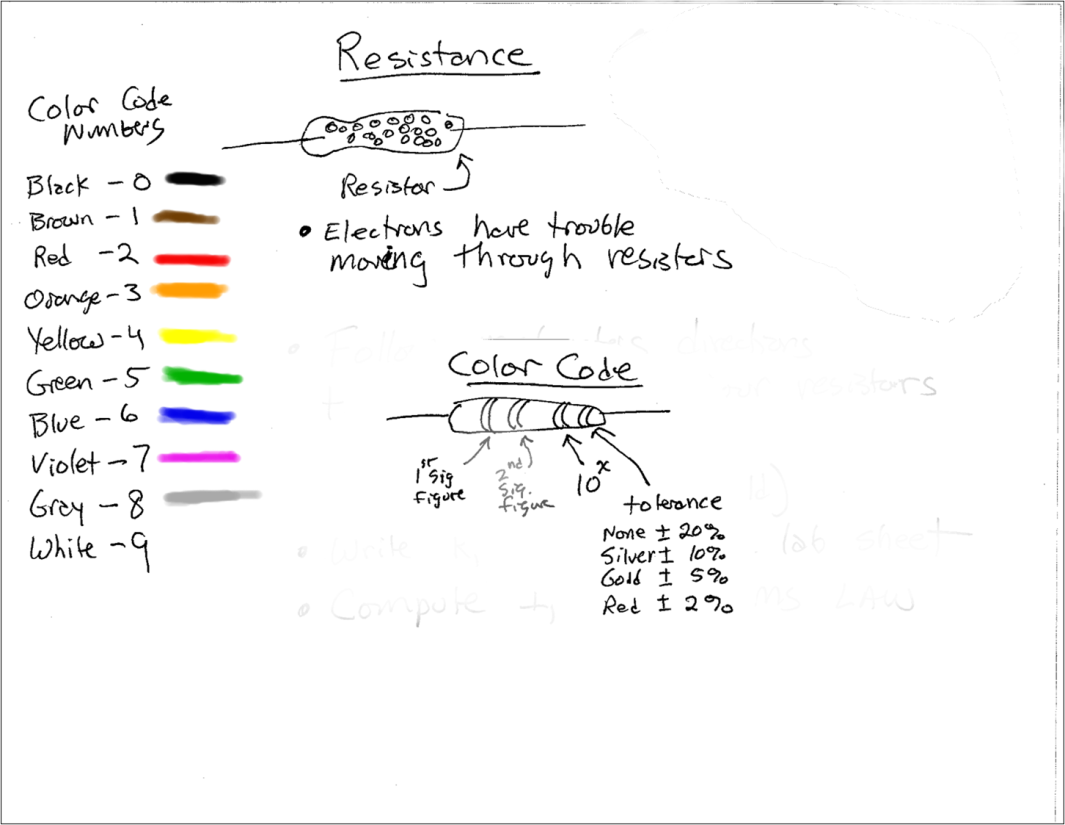
* For students to understand the basic electronic principles of digital circuits: power, energy, work, voltage, current, resistance, etc.
* Understand Kirchhoff’s voltage and current laws.

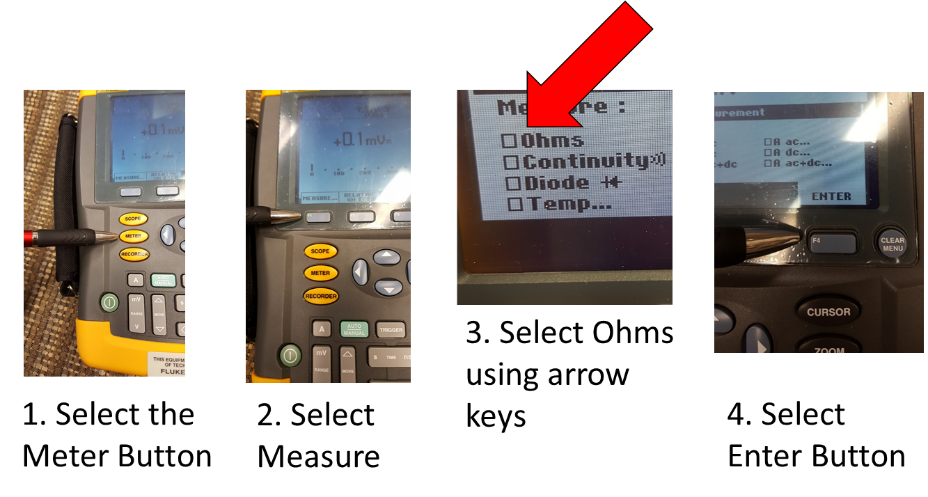
#### Exercise 1: Understanding Ohm’s Law : Measure all 4 of your Resistors

**Ohm’s law governs the flow of current in a circuit. This is a VERY IMPORTANT EQUATION!**

**Current ( amps ) = Voltage (volts) / Resistance (Ohms)**







R1 Ohms (label): 56\*10^2 Ohms (measured): 5.54kOhms

R2 Ohms (label): 39\*10^2 Ohms (measured): 3.83kOhms

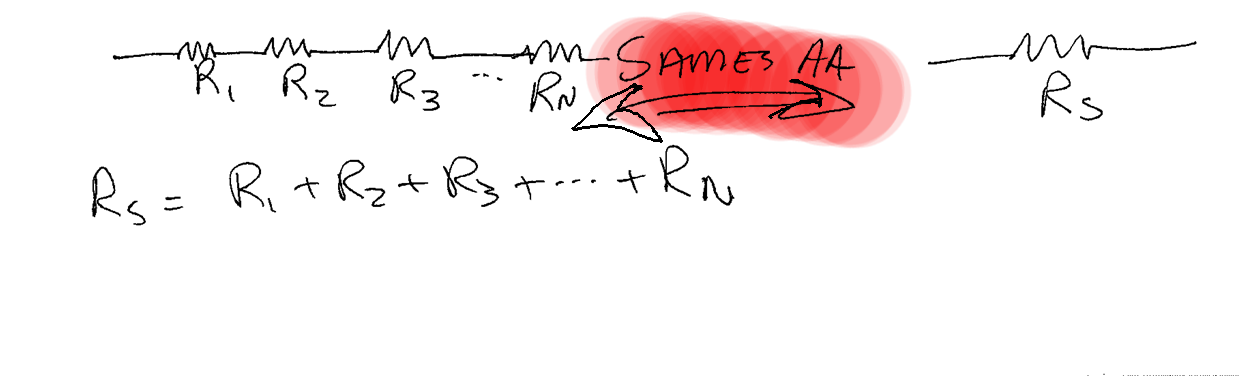
R3 Ohms (label): 10\*10^2 Ohms (measured): 0.98kOhms

R4 Ohms (label): 10\*10^2 Ohms (measured): 0.98kOhms

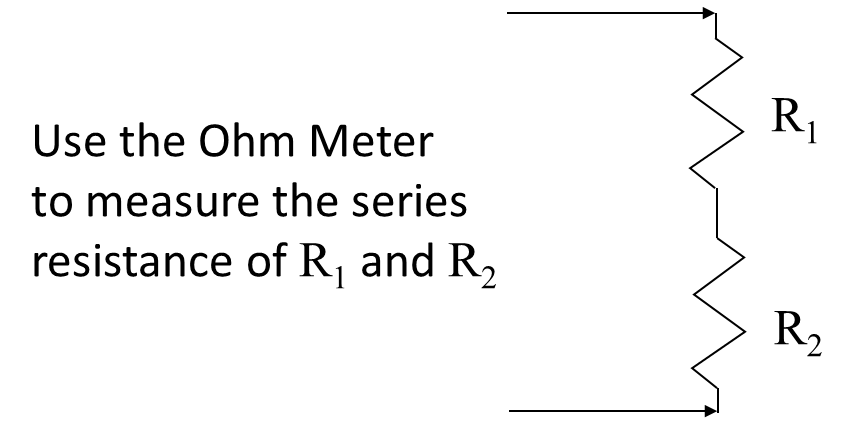
Why might possibly the resistances of R3 and R4 not have exactly the same measured values?

The tolerance of the resistor is +/-5%.

#### Exercise 2: Series Resistances Add

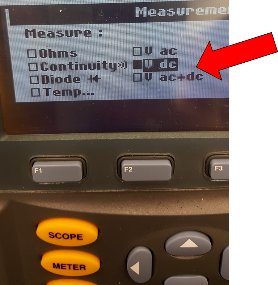


**Series Resistance Formula: RS = R1 + R2 + … + RN**

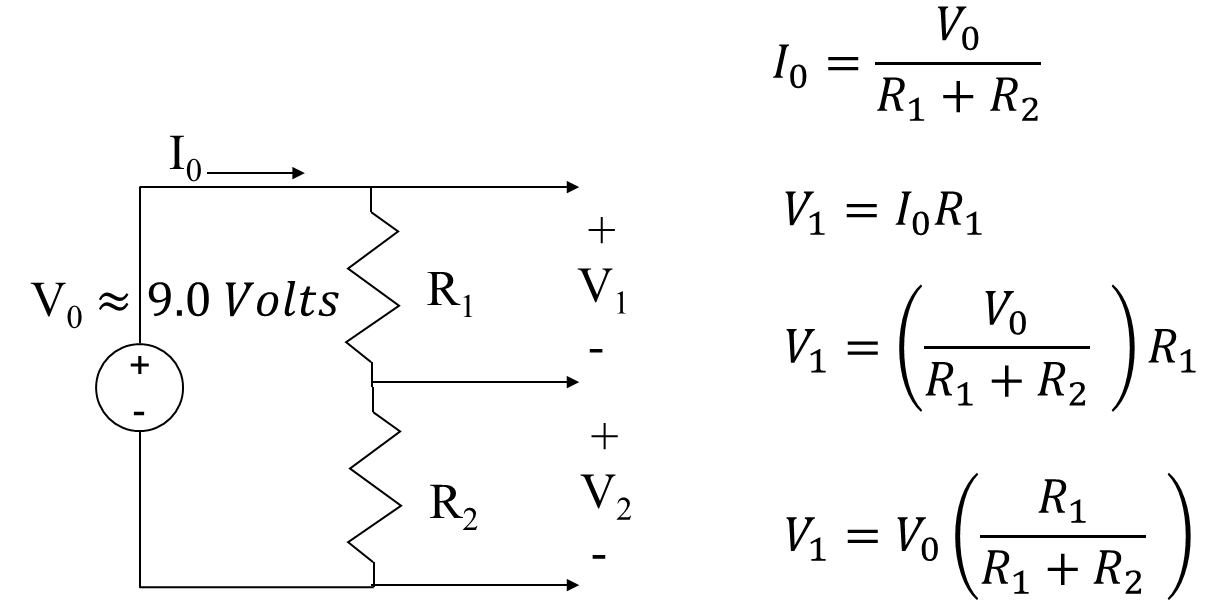


9.35kOhms

#### Exercise 3: Voltage Divider

IMPORTANT: SWITCH METER TO MEASRING Volts DC

Calculate V1 from measured resistances   
  
and assume V0 = 9 volts: 5.31v

Calculate V2 from measured resistances   
  
and assume V0 = 9 volts: 3.69v

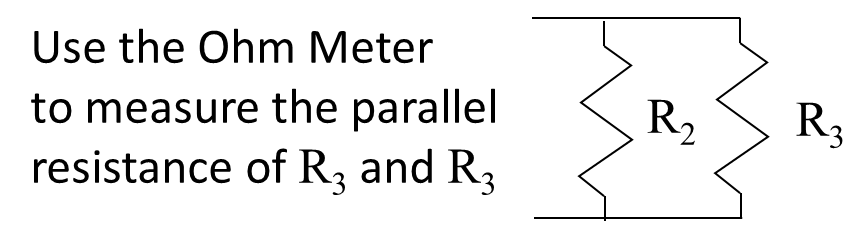
Measure V1 directly: 5.24v

Measure V2 directly: 3.62v

Do these values match exactly? Why or Why not?

No. Each resistor has a range of tolerance where the resistance can be +/- some resistance. So the actual measured voltage does not match the theoretical perfectly.

#### Exercise 4: Reciprocals of Resistances Add for Parallel Resistances

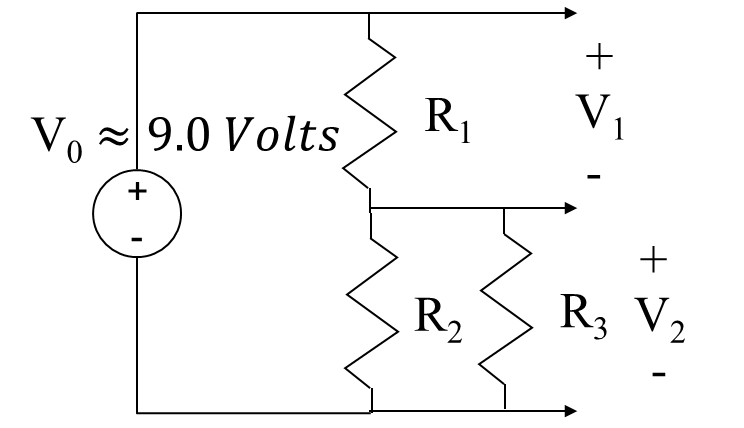
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**Parallel Resistance Formula:**

Sum (1/R1) + (1/R2) Ohms (from labels): 19/43680 RP = 1 / sum = 2299Ohms

Switch as needed between Voltage and Resistance Measurements…

Measure RP Directly = 2.17kOhms



Calculate V1: 6.38v

Calculate V2: 2.62v

Measure V1: 7.7v

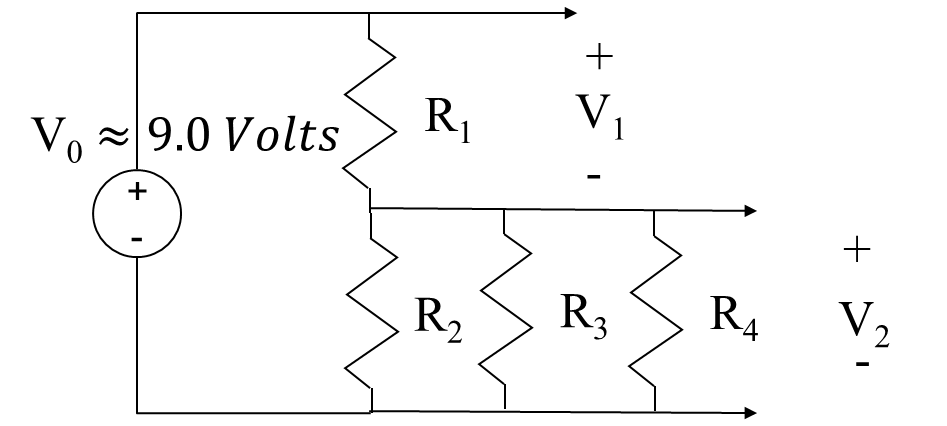
Measure V2: 1.09v

Do these values match exactly? Why or Why not?

No. There is a margin of error. One is theoretically calculated and one is physically measured.

#### Exercise 5: Calculate Output Voltage & Verify by Measuring it!

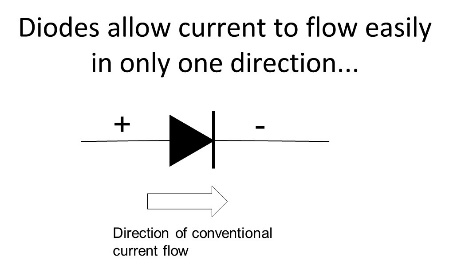
What will the output voltage V2 be if we add R4 parallel to R2 and R3?



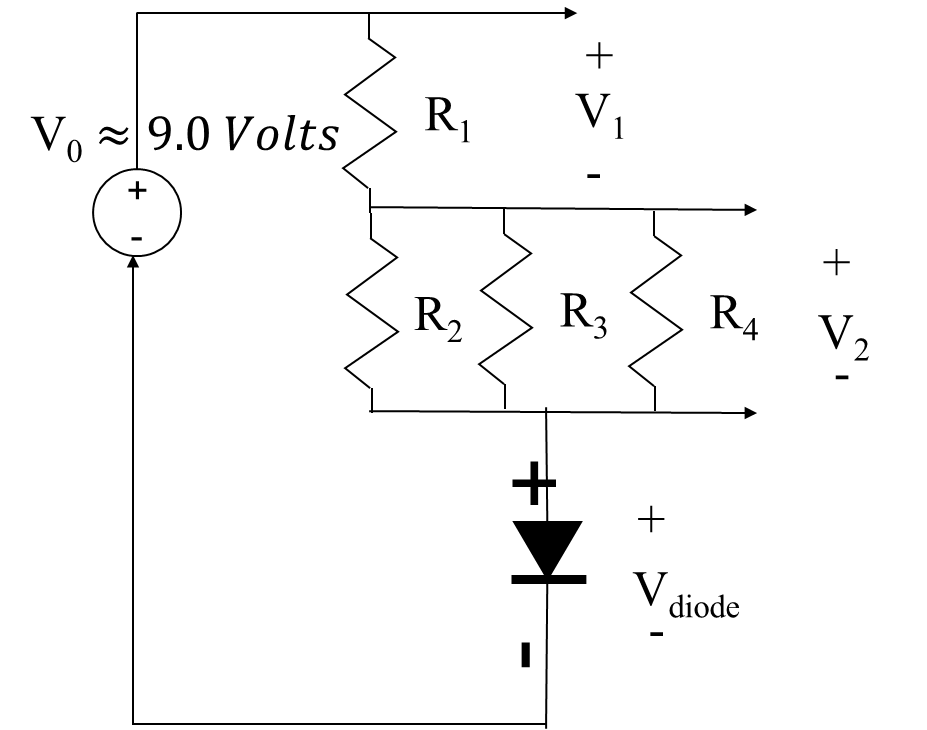
654.1mV

#### Exercise 6: Diodes Allow Current Flow in Only One Direction

Make sure the meter is set to measure ohms (resistance). Measure the resistance in both directions through the diode:

* 1. First direction resistance: 0 Ohms
  2. Second direction resistance: 488.9 Ohms

#### Exercise 7: Diode in a Circuit

Put the diode into the circuit as shown in the following image.

What is V1? 7.65v

What is V2? 0.6v

What is Vdiode? 0.62v

What is V1 + V2 + Vdiode? 8.87v

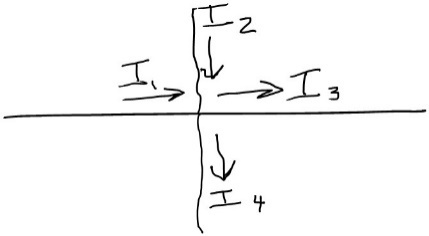
Does this sum equal the voltage of the power supply? Why or Why not?

The measured battery voltage is 8.9 volts. There is a margin error, so they are equal. Energy cannot be created nor destroyed (Physics).

Why did the voltages V1 and V2 change?

We added a new resistor to Rp

#### Exercise 8: Kirchhoff’s Current Law (KCL)



What does Kirchhoff’s Current Law state? The current going into and out of an intersection

is equal. Energy cannot be created or destroyed.

By convention, is current out of a node negative or positve?

The current is positive.

By convention, is current into a node negative or positive?

The current is positive.

#### Exercise 9: Kirchhoff’s Voltage Law (KVL)

What does Kirchoff’s Voltage Law state?

Sum of currents for any node is zero.

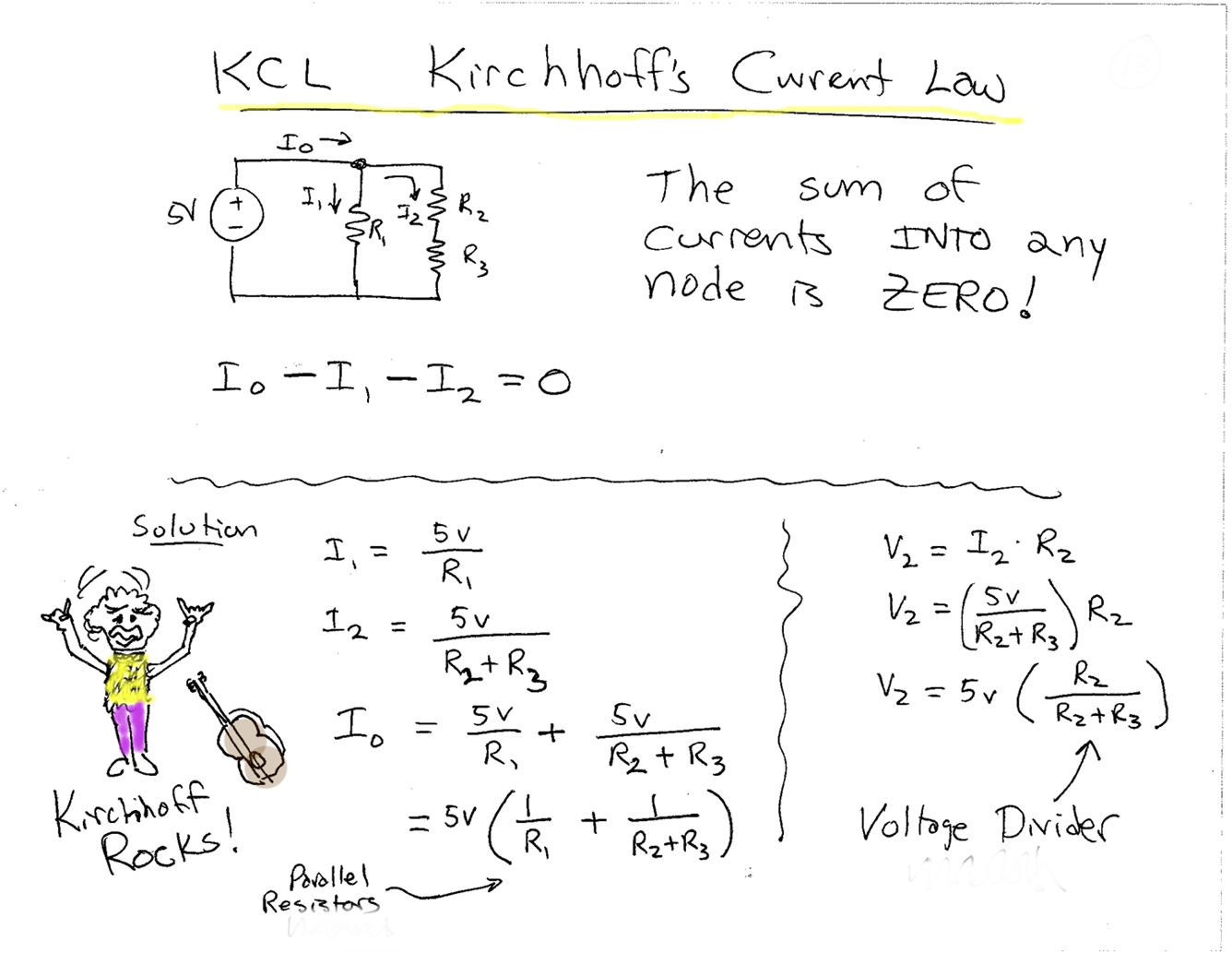
By convention, if travelling around a loop in a circuit,   
and we go from + to – across a voltage, is this a positive or negative drop?

Positive drop.

By convention, if travelling around a loop in a circuit,   
and we go from - to + across a voltage, is this a positive or negative drop?

Negative drop.

#### Exercise 10: Applying Kirchhoff’s Laws to Find Voltages and Currents in a Circuit



1. Write equations for the currents I0, I1, and I2 in terms of the resistances R1, R2 and R3   
   and the 5 volt power supply.

I1=5v/R1

I2=5v/(R2+R3)

I0=5v(1/R1+1/(R2+R3))

1. Write equations for the following voltage drops:
   * Over resistor R1 (call this voltage V1) V1=I2\*R2
   * Over resistor R2 (call this voltage V2 ) V2=(5v/(R2+R3))R2
   * Over resistor R3 (call this voltage V3 ) V3=5v(R2/(R2+R3))