ENGR210: GSA 1

Group Number: ____21______
Group Member #1 Name: _____Kara Hageman_______ Case ID: ___kah157____
Group Member #2 Name: _____Sophia Hestad________ Case ID: ___sbh34____
Group Member #3 Name: _____Jacob Alspaw________ Case ID: ___jaa134____
Group Member #4 Name: _____Jon Healy____________ Case ID: __jmh267___
Group Member #5 Name: _____Sarah Breland________ Case ID: __sab196___

Beneficial

1. Communication: nothing can get done if we aren't talking to each other. This starts with our ability to communicate what needs to be done before we meet so that while we meet we will get done what needs to get done
2. Making an Agenda: this allows us to stay focused and make sure everything gets done
3. Time management: this way everything that needs to get done gets done. This also keeps the work load from becoming too much
4. Effort: we need to put effort into the time plan to put in so that the work gets done and so that the work is quality
5. Enthusiasm: we have to want to do the work in order to get it done well and in a timely manner

Destructive

1. Negative Attitude: this pulls everyone down because negative people aren't doing work as well and bring others down
2. Unwilling to Co-operate: this does not contribute to the group and furthermore hinders the group from moving forward. Creates an uneven divide of work load
3. Distractions: this decreases efficiency by breaking concentration and taking up time
4. Not being prepared: this holds the group back because prepared members then have to catch the other member up or take the un-prepared person's work load
5. Close-Minded: this inhibits learning. Even if something is wrong it should be talked out as to why it is wrong so that the experience can be meaningful

High Performance

1. Being prepared: This shows that a person cares about the class and is ready to participate fully in the work that needs to get done during the meeting
2. Attentive: this allows work to get done. It is also just respectful. It is the only way for collaborative learning to happen is to know what the group is working on
3. Efficient: this shows that the person is paying attention and focused on the work. It keeps the group on track and helps them stick to the agenda
4. Engaging with the Group: this allows collaborative learning by sparking discussion. It allows for good questions to be asked and mistakes to be explained and learned from
5. Willingness to learn: without this people will not want to enter into discussion. Going through the motions does not culminate in long term learning and understanding

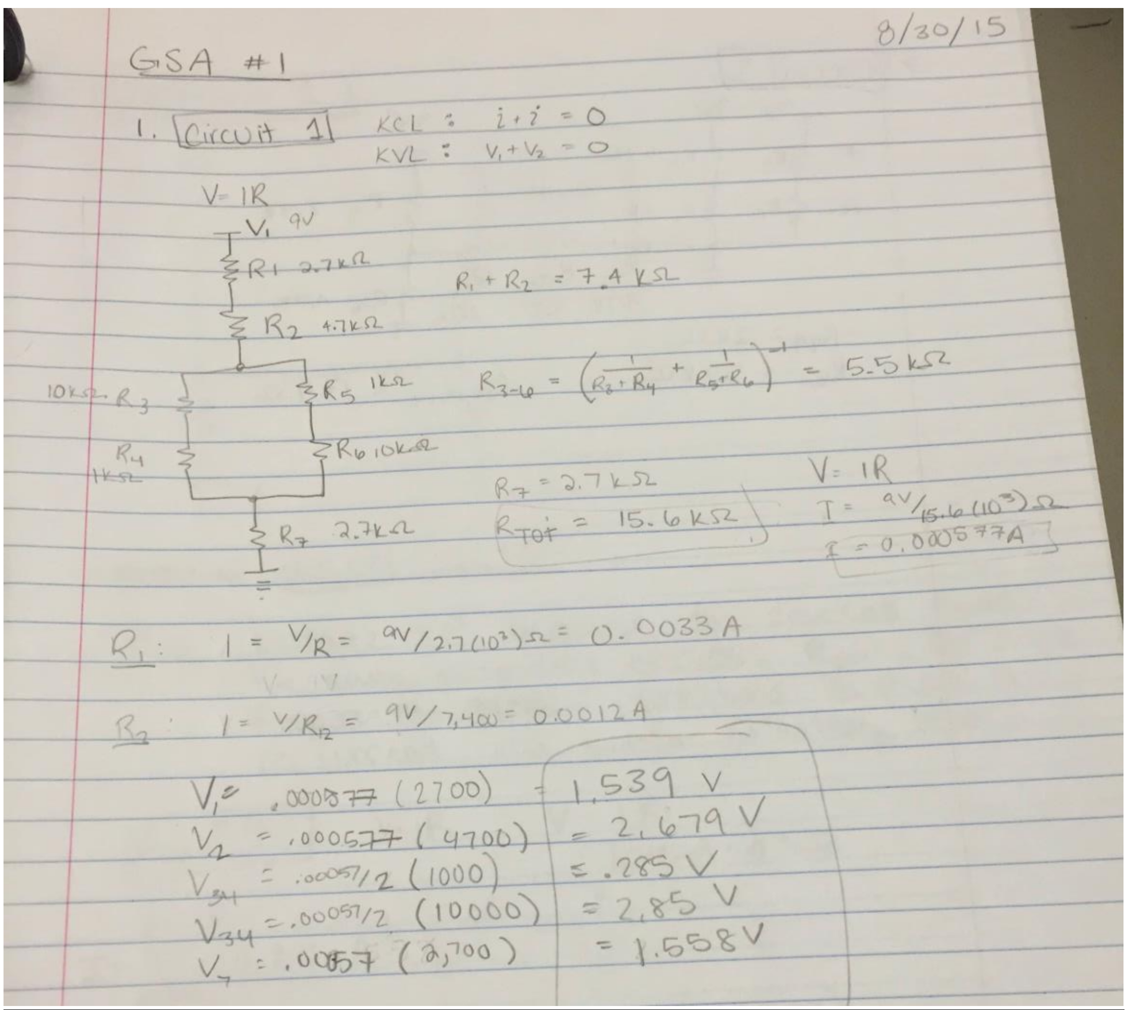
Low Performance

1. Too reserved: prevents good discussion, personal learning, and detracts from others ability to learn
2. Too arrogant: makes others uncomfortable asking questions. Others are unable to learn because they feel stupid. The arrogant one does not learn either because they don't acknowledge their mistakes or learn from them
3. Judgmental: this creates tension within the group because people are not able to express what they are thinking and if people can't do this then discussion can't happen and learning doesn't take place
4. Unmotivated: this takes up time and decreases the quality of the work. It slows everyone down and tends to rub off on members
5. Temperamental: prevents people from having good communication by decreasing the clarity of the what is being said

Meeting Time: Sunday night, late Monday night if needed

Part 1

<u>Circuit 1</u>



GSA #1 8/30/15

1. Circuit 1 KCL : $i + i = 0$

KVL : $V_1 + V_2 = 0$

$V = IR$

V_1 9V

R_1 2.7kΩ

R_2 4.7kΩ

10kΩ R_3

R_4 1kΩ

R_5 1kΩ

R_6 10kΩ

R_7 2.7kΩ

$R_1 + R_2 = 7.4\ k\Omega$

$R_{3-6} = \left(\frac{1}{R_3+R_4} + \frac{1}{R_5+R_6}\right)^{-1} = 5.5\ k\Omega$

$R_7 = 2.7\ k\Omega$

$R_{Tot} = 15.6\ k\Omega$

$V = IR$

$I = 9V / 15.6(10^3)\Omega$

$I = 0.000577A$

$R_1: \quad I = V/R = 9V/2.7(10^3)\Omega = 0.0033A$

$R_2: \quad I = V/R_{12} = 9V/7{,}400 = 0.0012A$

$V_1 = .000577\ (2700) = 1.539\ V$

$V_2 = .000577\ (4700) = 2.679\ V$

$V_{34} = .00057/2\ (1000) = .285\ V$

$V_{34} = .00057/2\ (10000) = 2.85\ V$

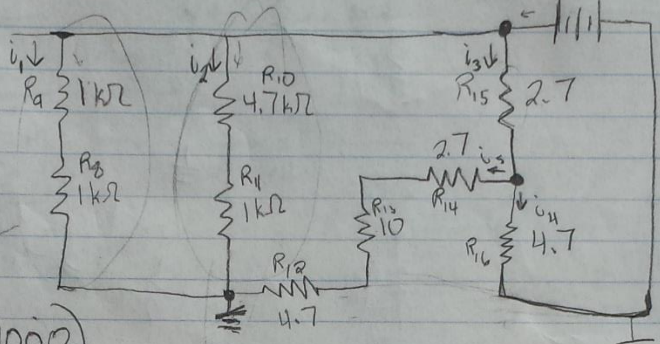
$V_7 = .0057\ (2{,}700) = 1.558V$

Circuit 2

Answers are negative because voltage drops!

Circuit #2

4V



$V = IR$

$4 = I(R_9 + R_8)$

$= I\,2000$

$.0045 = A$

$2.7 + \left(\frac{1}{2.7+10+4.7} + \frac{1}{4.7}\right)^{-1}$

6.4

$V_8 = (.0045)(1000)$

$\boxed{V_8 = -4.5V}$

$V_8 = V_9$

$\boxed{V_9 = -4.5V}$

$4 = I(R_{10} + R_{11})$

$4 = I(4.7 + 1)$

$1.574\,mA = I$

$V_{10} = (1.574)(4.7)$

$\boxed{V_{10} = -7.421V}$

$V_{11} = (1.579)(1)$

$\boxed{V_{11} = -1.579V}$

$V_{12} = (.44776)(4.7)$

$\frac{1}{R_{eq}} = \frac{1}{2} + \frac{1}{5.7} + \frac{1}{6.4}$

$R_{eq} = 1.2\ k\Omega$

$4 = I(1200)$

$.0075A = I_{TOT}$

$I_{TOT} - I_1 - i_2 - i_3 = 0$

$.0075 - .0045 - .001579 = i_3$

$.001421 = i_3$

$V_{15} = i_3 R_{15}$

$V_{15} = (.001421)(2700)$

$\boxed{V_{15} = -3.747V}$

$4 - 3.8367 = 5.1633$

$\boxed{V_{16} = -5.20V}$

$R_{eq_2} = 10 + 4.7 + 2.7 = 17.4$

$V = IR_{eq}$

$5.1633 = I(17400)$

$2.9674 \times 10^{-4} = I_5$

$V_{14} = (2.9674 \times 10^{-4})(2700)$

$\boxed{V_{14} = -0.81V}$

.8012

$V_{13} = (2.9674 \times 10^{-4})(10{,}000)$

$\boxed{V_{13} = -2.94V}$

$V_{12} = (2.9674 \times 10^{-4})(4700)$

$\boxed{V_{12} = -1.91V}$

Circuit 3

Open

OPEN

R_{26} $V = IR$

$V = \boxed{9V}$ because one path, one resistor

R_{TOT} of circuit for all closed loops

$$R = \left(\frac{1}{10+2.7+4.7} + \frac{1}{1}\right)^{-1} = 0.945\,k\Omega$$

$$R = 0.945 + 1 = 1.945\,k\Omega$$

$$R = \left(\frac{1}{1.945} + \frac{1}{2.7}\right)^{-1} = 1.13\,k\Omega$$

$$1.13\,\Omega + 4.7\,\Omega = \boxed{5.83\,k\Omega}$$

$$I_{23} = V/R = 9V/5.83\,k\Omega = \boxed{1.54\,mA}$$

$$V_{23} = 1.54\,mA \cdot 4.7\,k\Omega = \boxed{7.255V}$$

$$V_{25} = 9 - V_{23} = \boxed{1.745V}$$

$$I_{25} = V/R = 1.745/2.7\,k\Omega = \boxed{0.646\,mA}$$

$$I_{22} = V/R = I_{23} - I_{25} = 1.54 - 0.646\,mA = \boxed{0.894\,mA}$$

$$V_{22} = IR = .894(1) = \boxed{.894\,V}$$

$$V_{21} = 9V - (V_{22} + V_{23}) = \boxed{0.851V}$$

$$I_{21} = V/R = 0.851/1 = 0.851\,mA$$

$$I_{20} = I_{22} - I_{21} = 0.894 - 0.851 = 0.043\,mA$$

$$V_{20} = IR = 0.043(4.7) = \boxed{0.202V}$$

$$V_{19} = IR = .043(2.7) = \boxed{0.116V}$$

$$V_{18} = IR = .043(10) = \boxed{0.43V}$$

Switch & V_{17} = 0V it is not in a connected loop

$V_{24} = 0V$

Closed

① Circuit #3 SWITCH CLOSED

$V_{R26} = 9V$ because only one resistor along path. Must be full voltage drop.

$V_{R24} = 0V$ because both voltage sources have equal potential across resistor$_{24}$, but are in opposite direction. Therefore, no current, no voltage drop.

$$V_{R23} + V_{R25} - 9 = 0$$
$$V_{R23} + V_{R22} + V_{R21} - 9 = 0$$
$$V_{R23} + V_{R22} - V_{R20} - V_{R19} + V_{R18} - 9 = 0$$
$$V_{R17} + V_{R19} + V_{R20} + V_{R21} - 9 = 0$$
$$V_{R17} + V_{R18} - 9 = 0$$

$$I_{R23} = I_{R25} + I_{R22}$$
$$I_{R21} = I_{R22} + I_{R20}$$
$$I_{R17} = I_{R19} + I_{R18}$$

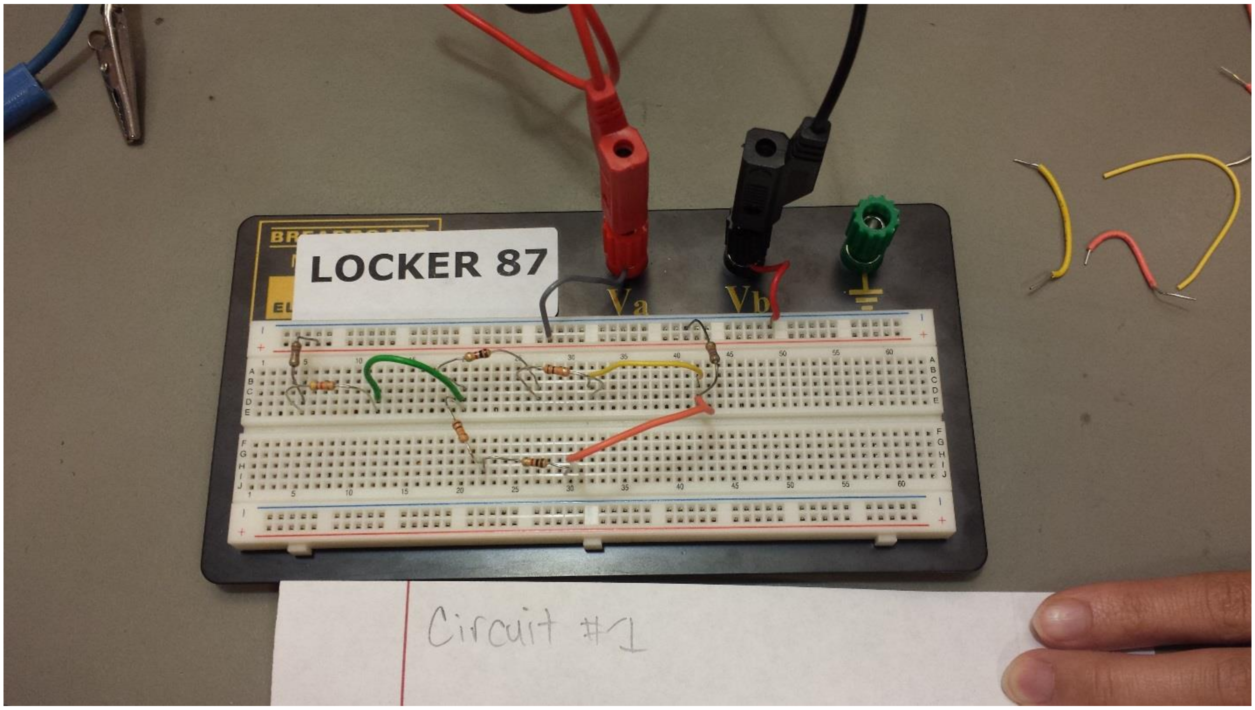
$$\frac{V_{R23}}{R_{23}} = \frac{V_{R25}}{R_{25}} + \frac{V_{R22}}{R_{22}} \rightarrow \frac{V_{R23}}{4.7} = \frac{V_{R25}}{2.7} + \frac{V_{R22}}{1}$$
$$\frac{V_{R21}}{R_{21}} = \frac{V_{R22}}{R_{22}} + \frac{V_{R20}}{R_{20}} \rightarrow \frac{V_{R21}}{1} = \frac{V_{R22}}{1} + \frac{V_{R20}}{4.7}$$
$$\frac{V_{R17}}{R_{17}} = \frac{V_{R19}}{R_{19}} + \frac{V_{R18}}{R_{18}} \rightarrow \frac{V_{R17}}{1} = \frac{V_{R19}}{2.7} + \frac{V_{R18}}{10}$$
$$\frac{V_{R19}}{R_{19}} = \frac{V_{R20}}{R_{20}} \rightarrow \frac{V_{R19}}{2.7} = \frac{V_{R20}}{4.7}$$

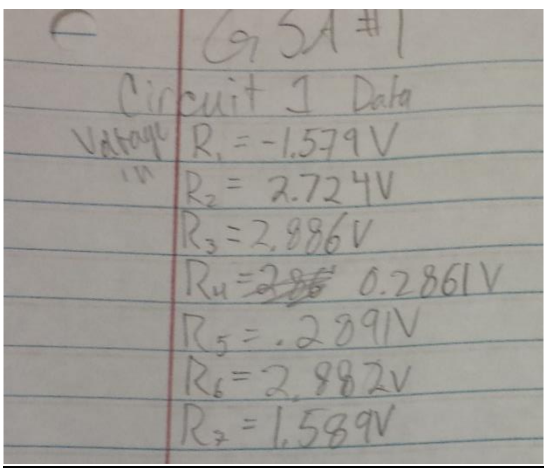
☆ Solving our system of equations:

$V_{R25} = 2.14V$	$V_{19} = 2.18V$	$V_{R26} = 9V$
$V_{R23} = 6.86V$	$V_{18} = 7.45V$	$V_{R24} = 0V$
$V_{R22} = 0.67V$	$V_{17} = 1.55V$	
$V_{R21} = 1.47V$		
$V_{R20} = 3.79V$		

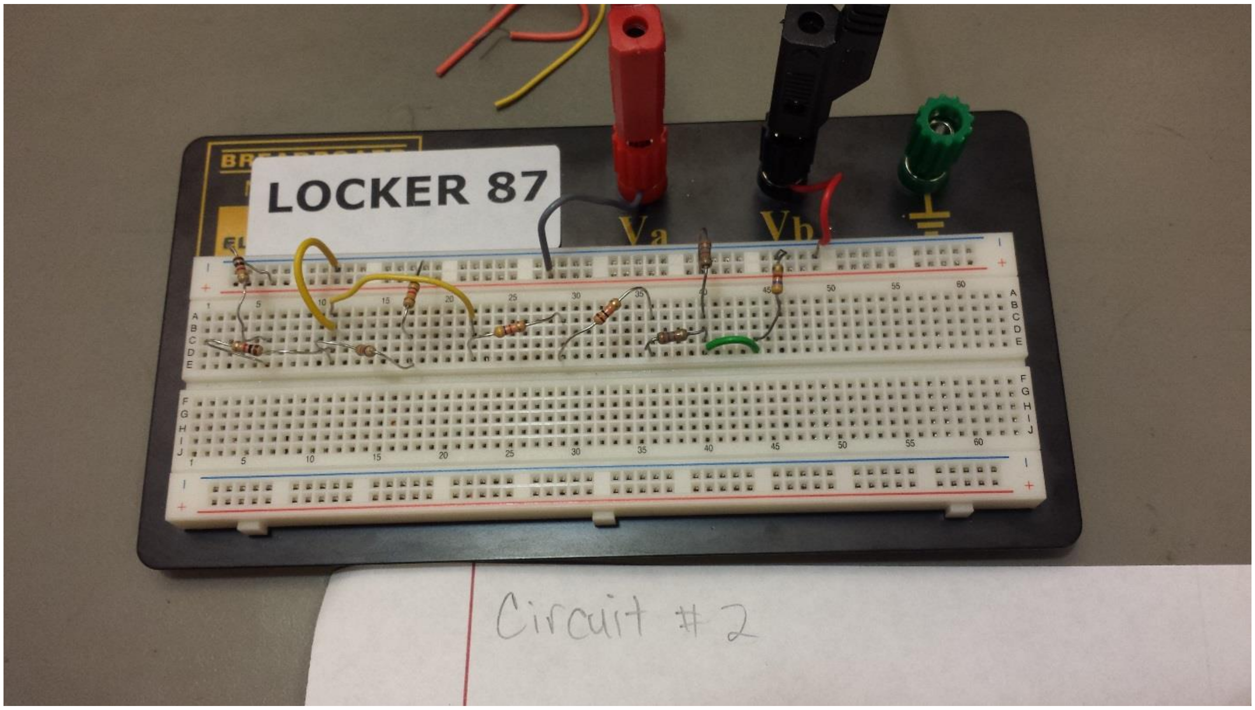
Part 2

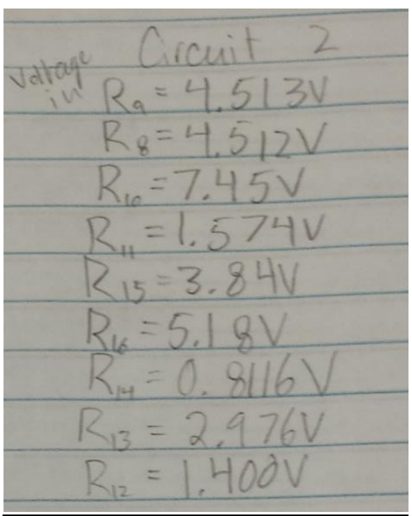
<u>Circuit 1</u>





<u>Circuit 2</u>





Circuit 2

Voltage in

$R_9 = 4.513V$

$R_8 = 4.512V$

$R_{10} = 7.45V$

$R_{11} = 1.574V$

$R_{15} = 3.84V$

$R_{16} = 5.18V$

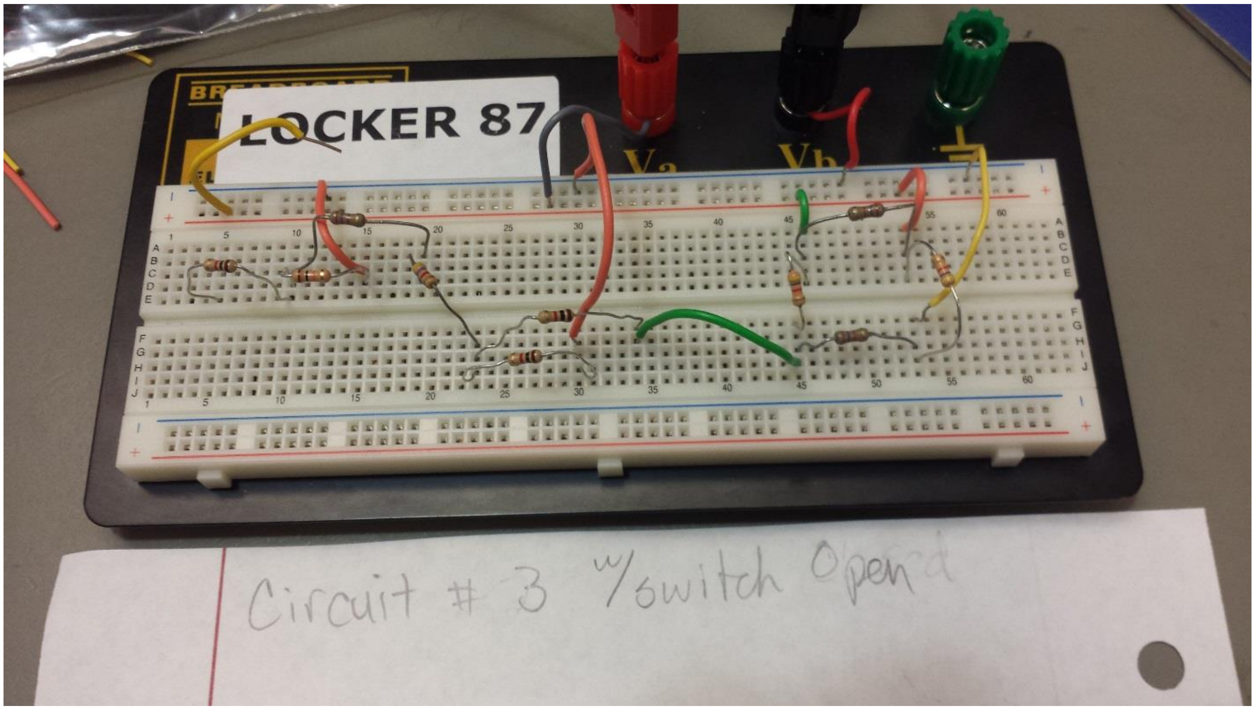
$R_{14} = 0.8116V$

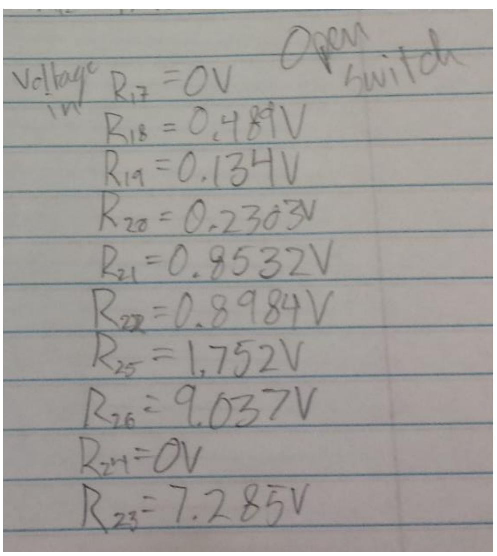
$R_{13} = 2.976V$

$R_{12} = 1.400V$

Circuit 3

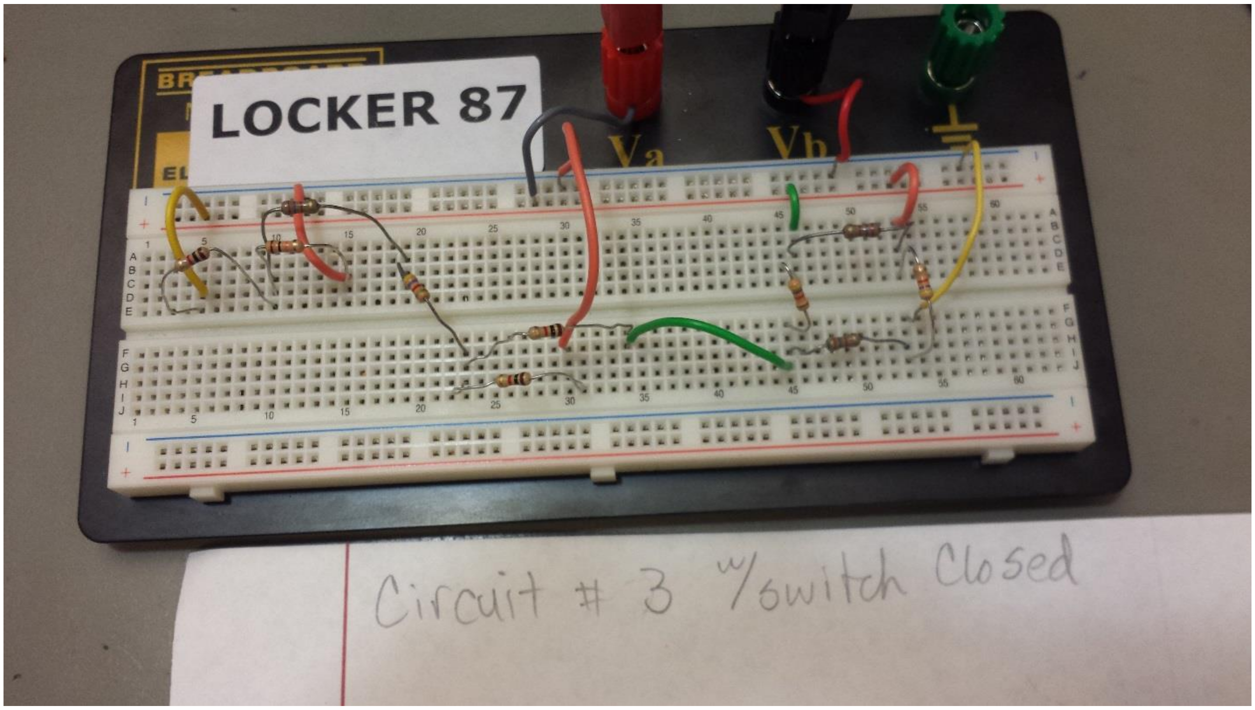
Open

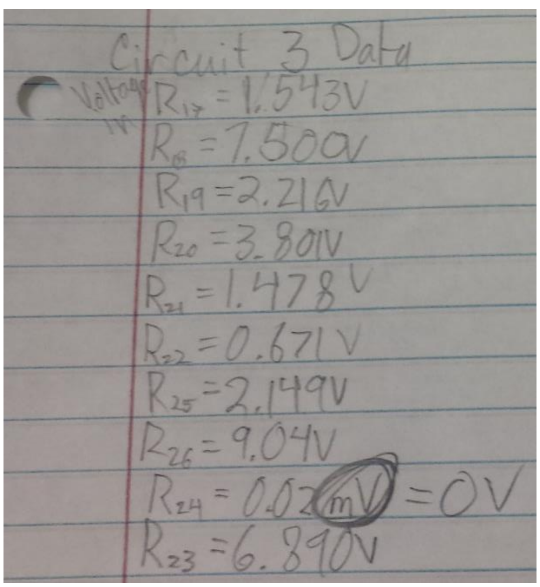



Open switch

Voltage in
R_{17} = 0V
R_{18} = 0.489V
R_{19} = 0.134V
R_{20} = 0.2303V
R_{21} = 0.8532V
R_{22} = 0.8984V
R_{25} = 1.752V
R_{26} = 9.037V
R_{24} = 0V
R_{23} = 7.285V

Closed




Circuit 3 Data

Voltage in

R_{17} = 1.543V

R_{18} = 1.500V

R_{19} = 2.216V

R_{20} = 3.801V

R_{21} = 1.478V

R_{22} = 0.671V

R_{25} = 2.149V

R_{26} = 9.04V

R_{24} = 0.02 mV = 0V

R_{23} = 6.890V

Part 3

The measured and calculated values for circuit 1 and 2 are similar, but are not exact. This could be for a multitude of reasons: experimental error, uncertainty in the magnitude of resistance, non-ideal wires, and carrying over significant figures. Our group is not absolute in our experiment. There will always be a source of error by some marginal value. It is possible our group measured over the wrong wire, or perhaps in series when we needed to measure in parallel. There are many possibilities that could spoil results. However, I believe the human error our group made is minimal because our measured results matched our calculations. Moreover, the resistors are not perfect resistors and, in actuality, have resistance within a range of their labeled value. A 1000 Ohm resistor could have an allowable uncertainty of 10% for the manufacturer to certify it, resulting in resistor that could be 100 Ohms more or less than its labeled value. This discrepancy in resistance magnitudes could be a large contributor to the differences in measurements and theoretical values. But it doesn't stop there; in conjunction with forgoing the imperfections in resistors into our calculations, neither are the resistances of the wires themselves. In calculations, we assume wires are ideal and supply no resistance, but this is simply not true. Every wire has some magnitude of resistance along its path. Lastly, throughout the calculations, our group was consistently rounding to match significant figures the best we could. Over the course of the totality of arithmetic involved in these calculations, the rounding errors compounded onto one another. When we compare these rounded values to the measured values, there will be a difference, even though slight, because the machines, the DMMs specifically, do not take the rounding of significant figures into consideration. The measurement tools do not limit themselves to a certain amount of digits.