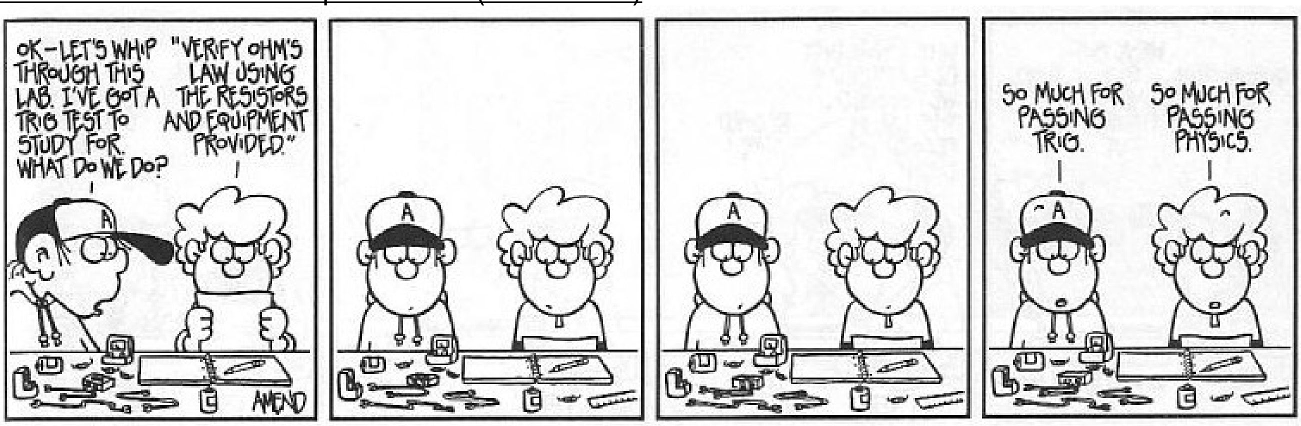
Name: ___________________________

Edison and Resistance

SPH4C

Part 1: Resistance in Simple Circuits (Ohm's Law)



Connect a 4.5 V battery to a 100.0 Ω resistor (which may be found in the top left corner of the worktable; click on the top left corner to change the components available) in series with an ammeter (which may be found in the bottom right corner of the worktable). Be sure to connect the positive terminal of the battery to the positive (red) input of the ammeter. Enter your current data in the table below. Double click on the resistor to open its information pop-up in the Schematic Analyser and change the value of the resistance to 80.0 Ω. Enter your current data in the table below. Repeat for values of 60.0 Ω, 40.0 Ω, and 20.0 Ω.

Table 1: Current Through a Circuit of Varying Resistance

Potential Difference V (V)	Resistance R (Ω)	Current I (mA = milliamperes)	Current I (A)
4.5	100.0		
4.5	80.0		
4.5	60.0		
4.5	40.0		
4.5	20.0		

On the grid at right, graph your data with resistance on the horizontal axis and current on the vertical axis. Draw your curve of best fit through the points.

As the resistance decreases, the current through the

circuit __________________.

Clear your worktable. Connect a DC power supply (by default set on 5.0 V) to a 50.0 Ω resistor in series with an ammeter. Be sure to connect the positive (red) terminal of the battery to the positive (red) input of the ammeter. Enter your current data in the table below. Click on the dials of the power supply to adjust the potential difference to 4.0 V. Enter your current data in the table below. Repeat for values of 3.0 V, 2.0 V, and 1.0 V.

Table 2: Current Through a Circuit Supplied With Varying Potential Difference

Resistance (Ω)	Potential Difference (V)	Current (mA)	Current (A)
50.0	5.0		
50.0	4.0		
50.0	3.0		
50.0	2.0		
50.0	1.0		

On the grid at right, graph your data with current on the horizontal axis and potential different on the vertical axis. Draw your line of best fit through the points.

As the potential difference decreases, the current

through the circuit ____________________.

Find the slope of the line through the points (in units of V/A *not* V/mA).

What is the relationship between the slope of the line and the resistance of the circuit?

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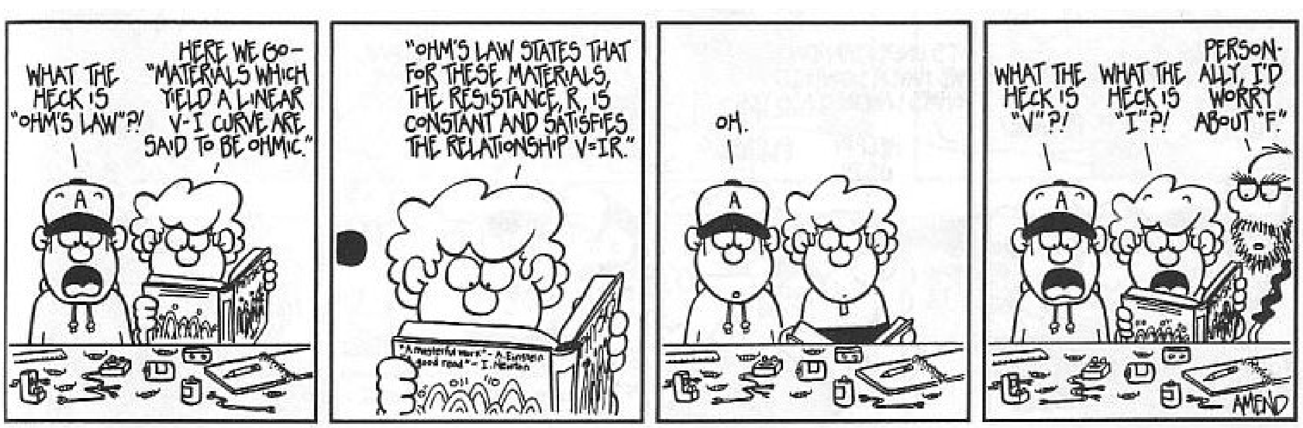
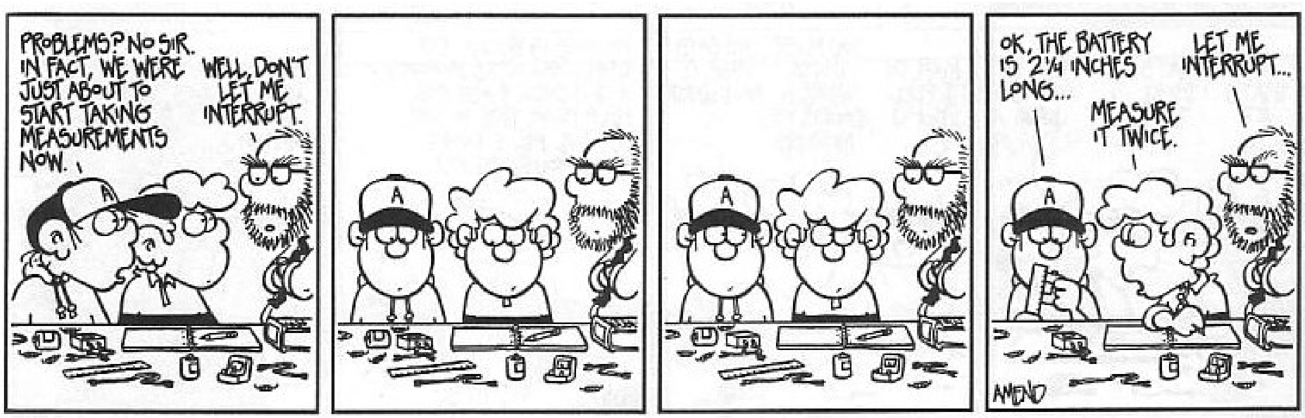
Is this what you expect, given that $I = \frac{V}{R}$ or $V = IR$?





Part 2: Resistors in Series and Parallel (Equivalent Resistance)

Clear your worktable. Connect an ohmmeter, which measures total or equivalent resistance, to one 50.0 Ω resistor. (You should not include a battery or DC power supply when using an ohmmeter!) Enter your equivalent resistance data in the table on the next page. Add another 50.0 Ω resistor in series with the first resistor and the ohmmeter. Enter your equivalent resistance data in the table on the next page. Repeat, adding a third, a fourth, and a fifth 50.0 Ω resistor in series.

Table 3: Equivalent Resistance of Resistors in Series

Number of 50.0 Ω resistors in series	Equivalent resistance (Ω)
1	
2	
3	
4	
5	

As the number of resistors in series increases, their equivalent resistance ____________________.

(The equivalent resistance is equal to the _____________ of the resistances of resistors in series.)

So increasing the number of resistors in series in a circuit would ____________________ the current through the circuit.

Clear your worktable. Again, connect an ohmmeter to one 50.0 Ω resistor. Enter your equivalent resistance data again in the table below. Add another 50.0 Ω resistor in *parallel* with the first resistor. Enter your equivalent resistance data in the table below. Repeat, adding a third, a fourth, and a fifth 50.0 Ω resistor in parallel.

Table 4: Equivalent Resistance of Resistors in Parallel

Number of 50.0 Ω resistors in parallel	Equivalent resistance (Ω)
1	
2	
3	
4	
5	

As the number of resistors in parallel increases, the equivalent resistance ____________________.

So increasing the number of resistors in parallel in a circuit would _____________________ the current through the circuit.

The formula for the equivalent resistance when resistors are in parallel is:

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$$

Use this formula to calculate the equivalent resistance of a 10.0 Ω resistor and 15.0 Ω resistor in parallel:

Calculate the current that would flow through the circuit if a 12.0 V battery were connected to these resistors:

Build the circuit described above in the Edison program and verify that the current found above is the current that flows through the circuit. Now use Edison to determine the current flow through each individual resistor.

Current through the 10.0 W resistor = _______________

Current through the 15.0 W resistor = _______________

What can you conclude about the current across the resistors? _____________________________

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