Build Your Own Circuits

a mini-lab designed for PHYS 480 students
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0) Check your equipment.

1 9V battery
1 “bread board” (circuit board) and some wire connectors
1 multimeter (should be able to read DC amps and DC voltage)
3 resistors: 1 each with resistance 100Ω, 200Ω, 300Ω
2 capacitors: 1 each with capacitance 0.3μF

1) Safety warnings

Do not short-circuit the battery. Connecting the + and - terminals to each other directly will short the battery and it will overheat.

Do be sure the multimeter is connected correctly and the dial is set the way you think it is. If the meter is set up for “amps” when you think it is set to “volts,” you might cause a short circuit.

2) Check the terminal voltage of the battery.

A so-called 9V battery will not always produce exactly 9.000 volts. Set up the multimeter to check DC volts and touch one prong to each terminal. Write down the number, which should hopefully be close to 9. (Connecting the multimeter backwards will produce a negative voltage.)

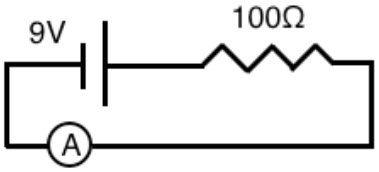
2) Predict the results of each experiment.

For the circuit diagrams on the next page, replace “9V” with the battery terminal voltage you just measured. Calculate what the currents and/or voltages will be. Neglect any resistance from the battery and/or wires.

3) Build the circuits and test your results.

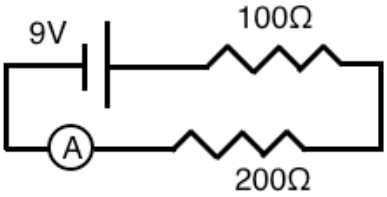
Build the circuits and write down the measured currents and/or voltages. Compare these to your calculated results and write down the difference and % error. Are the currents smaller or larger than your predictions? Argue with your group members about what caused the errors.

Circuit I



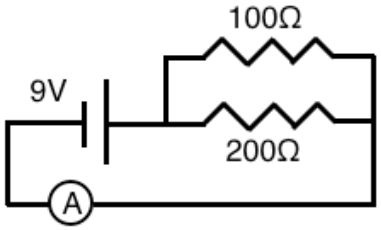
Find the current through the ammeter.
Predicted: _____ Error: _____
Measured: _____ % Error: _____

Circuit II



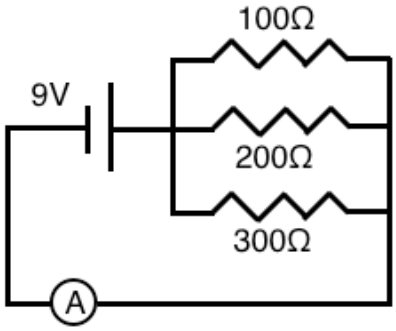
Find the current through the ammeter.
Predicted: _____ Error: _____
Measured: _____ % Error: _____

Circuit III



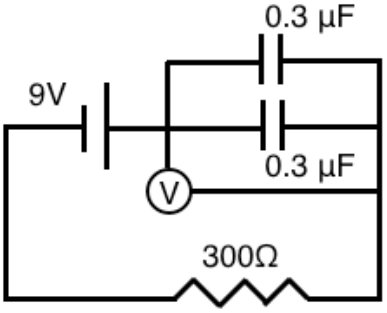
Find the current through the ammeter.
Equivalent Resistance: _____
Predicted: _____ Error: _____
Measured: _____ % Error: _____

Circuit IV



Find the current through the ammeter.
Equivalent Resistance: _____
Predicted: _____ Error: _____
Measured: _____ % Error: _____

Circuit V



Equivalent capacitance: _____
Time constant RC: _____
What does the voltmeter read when the capacitors are nearly full ($t >> RC$) ?
Predicted: _____ Error: _____
Measured: _____ % Error: _____