Name:_____ UIN: | | | | | | | | | | Section AB/BB: |

Unit 1 Report: Circuits, Laws, and Equipment

Reflections

Review your lab 1 procedure. You should find that in addition to gaining experience with the multi-meter and the power supply, you modeled the motor as a resistor and witnessed that the NiMH battery is definitely not an ideal voltage source.

Review your lab 2 prelab and procedure. You gained an introduction to the use of MATLAB as a tool for analysis (one aspect of scientific computing). You learned to connect switches and to use resistors as current-limiting devices to slow your motor. Out of necessity, you learned to utilize networks of resistors to accomplish this goal. Each of your two resistor networks had an equivalent resistance designed to achieve the proper wheel speed and also a power rating high enough that they would not result in circuit failure. As an engineer-in-training, you learned to validate your design through measurements taken using your benchtop hardware.

Review your lab 3 prelab and procedure. As you learned about Kirchhoff's laws, you also found that smaller "tweaks" in your resistor network could lead to better speed control. You may have even exceeded power ratings, but only in short time bursts (note that power ratings are actually specific to the way in which the device is used). You found that in a controlled system, time-varying signals cannot be purely analyzed using DC analysis tools. In this introduction to the oscilloscope, you found that the oscilloscope provides a window into the time-varying behavior of your circuits. You also continued your engineer-in-training practice by validating Kirchhoff's laws on your own car.

Review your lab 4 prelab and procedure. The extension of Kirchhoff's laws to voltage-divider circuits allowed us to design a cloud-detector. We gained valuable practice in reading datasheets for electronic components and we learned to connect a DIP-packaged IC to our breadboard, supplying it with "power and ground". While the prelab consisted of "blind, hobbyist-style" work, the laboratory environment allowed us to gain "engineer-level" insight into the time-varying behavior of the cloud-detector circuit via the oscilloscope. We learned more about the *triggering* operation of the oscilloscope which is central to our understanding of the information it provides us. We moved away from poor-efficiency, current-limiting resistors. Instead, we use a MOSFET transistor as a motor switch that is controlled by a voltage-divider circuit. A single resistive device, the

potentiometer, provides a great, low-power way to quickly adjust wheel speed while the MOSFET allows for a large increase in power efficiency.

Unit 1 Report

You are asked to now provide a report for the unit of this lab that reviews **laboratory exercises 1 through 4**. In a document of 2 to 4 pages, you are expected to thoughtful evaluations supported by your data. In particular, your report should touch upon these aspects:

- The efficiency, η, of the current-limiting design for motor-speed control (reference Experiment #3). Solve for a numeric estimate of η.
- The efficiency, η, of the MOSFET-based design for motor-speed control (reference Experiment #4). Solve for a numeric estimate of η.
- The agreement (or disagreement) of actual measurements taken to confirm Kirchhoff's laws.
- The use of the equipment: Ohmmeter, voltmeter, ammeter, power supply, battery, oscilloscope.
- The modules you completed and their learning objectives.

Just do your best and feel free to discuss these topics with classmates, but **do not just copy answers** or you will be penalized for plagiarism. Do not sub-divide the labor. Work collaboratively to produce a solid work that both partners understand and agree with.

Notes: