1. [30 pts] For this problem you will make decisions about how to design a quasi-experiment to examine differences between brands of batteries. This is a quasi-experiment because battery brand is an observational factor that cannot be assigned at random to experimental material. In particular, the battery brands are Energizer, Duracell, and Radio Shack. You have a simple circuit that can accommodate a single battery attached to a small electric motor. There is a switch in the circuit that can be used to turn on and off the motor. The idea of the experiment is to run the motor to put a load on the battery, draining some of the battery’s power. You also have a digital multi-meter that can be used to measure voltage.

b) [2] What are the conditions of the experiment?
c) [2] What is the experimental material?
d) [4] Give two outside variables that should be controlled in the experiment. Explain why each should be controlled and how you will control each variable.
e) [2] Give an outside variable that cannot be controlled.
f) [2] Can you have a “control group” in this experiment? If yes, what would be the control group? If no, explain why.
g) [2] Explain how you would achieve replication within this experiment.
h) [2] With three battery brands we wish to be able to detect a difference in response means equal to 0.9 standard deviations with Alpha = 0.05 and Beta = 0.10. How many batteries will you have to buy?
i) [2] With three battery brands you can only afford to buy a total of 27 batteries. Give two combinations for Alpha, Beta and the size of the difference between two means (Δ) that correspond to this number of batteries.
j) [4] Use Col Shuffle in JMP to produce a single random sequence for the numbers 1 to 27. Include this with your take home answers and explain how to use this to produce a randomized order in which the 27 batteries will be tested.
k) [3] Why is a randomized order of testing important? Be sure to answer this question using the context of the problem.
l) [3] Suppose at the end of the experiment there are statistically significant differences among some of the brands. Specifically, suppose Duracell had the best average response and it was significantly better than the other two brands. What generalization can you make?