1. Breadboards and Schematics
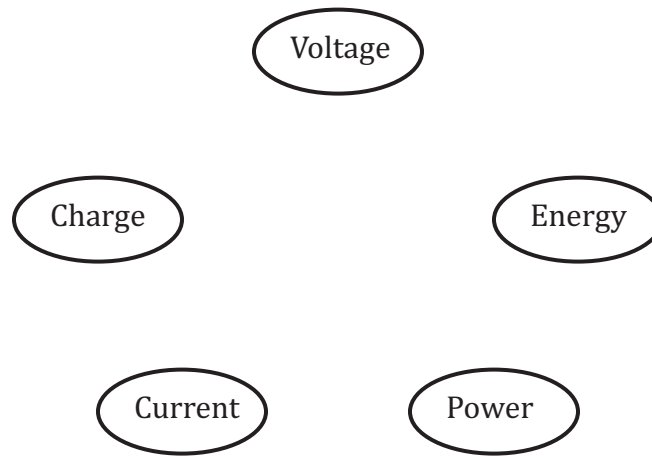
Please draw the schematics associated with the two breadboards shown in discussion.

2. Fundamental Quantities in Electronics

(a) Write down three things that you associate with each bubble.

(b) Draw lines between intrinsically connected quantities.

(c) For each line that you drew, write an equation describing the relationship.

3. A tiny spark!

Your friend Beatrix has made the mistake of rubbing her feet on a shaggy rug before touching a doorknob. When her hand gets close, a tiny spark shoots from her fingertip!

(a) Suppose that you know that the electric field required for this event to occur is 3×10^6 V/m. How much voltage does Beatrix's body have if the length of the spark is 1mm?

(b) Now let's say that you use a very precisely calibrated charge measuring device to determine that Beatrix had accumulated a total of 600pC of charge before the spark. Quantify the amount of energy in the spark.

(c) A spark like this typically lasts around 1 μs. Quantify the current in the air between Beatrix and the doorknob as well as the power in the spark.

(d) Now let's talk about a bigger spark. A bolt of lightning also takes around 1 μs. But it happens over a distance of 1km. And a storm cloud has approximately 1 μC of charge. How much power is in a lightning strike?

4. Jump starting a car

Your discussion TA left their lights on and their car won't start. Lucky for them, a friendly former Governator happened to be driving by and he has a few minutes to help.

(a) Given two cables (one red and one black), connect your TA's battery to the governor's.

(b) A fully charged car battery has a voltage across its terminals of 12V. Your TA's battery is measuring a measly 10V. What will happen when you connect the two?

(c) Your TA's car draws 100A when you turn the ignition. Describe what happens if:

    i. Immediately after connecting the two batteries, you attempt to start the car.

    ii. You wait a long time between connecting the two batteries and then attempt to start the car.