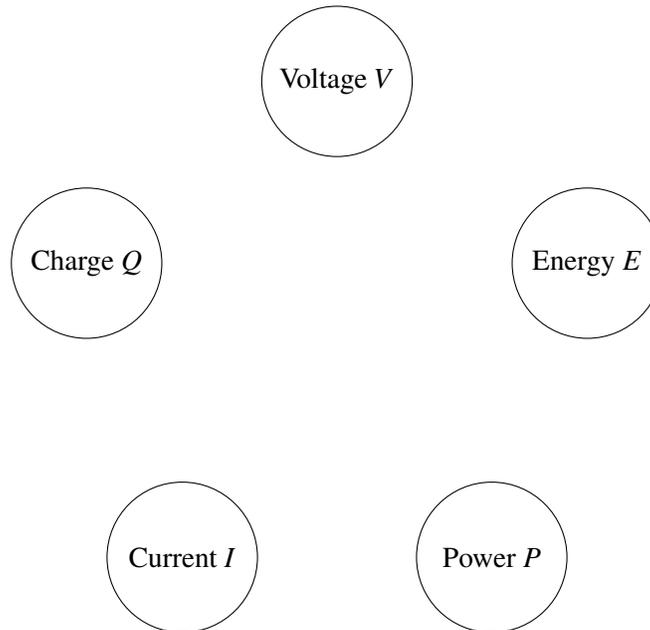


1. Fundamental Quantities in Electronics



- Write down three things that you associate with each bubble.
- Draw lines between intrinsically connected quantities.
- For each line that you drew, write an equation describing the relationship.

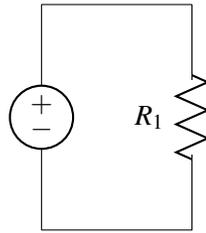
2. A Tiny Spark!

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

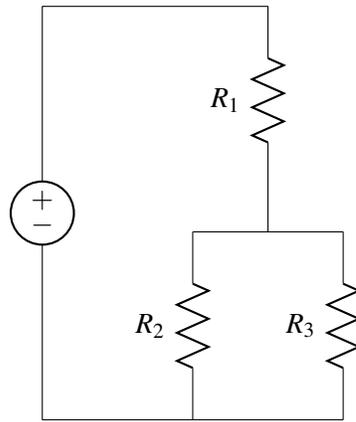
- Suppose that you know that the electric field required for this event to occur is $3 \times 10^6 \frac{\text{V}}{\text{m}}$. How much voltage does Beatrix's body have if the length of the spark is 1 mm?
- Now let's say that you use a very precisely calibrated charge measuring device to determine that Beatrix had accumulated a total of 600 pC of charge before the spark. Quantify the amount of energy in the spark.
- 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.
- Now let's talk about a bigger spark. A bolt of lightning also takes around 1 μs . But it happens over a distance of 1 km. And a storm cloud has approximately 1 μC of charge. How much power is in a lightning strike?

3. Circuits As Graphs

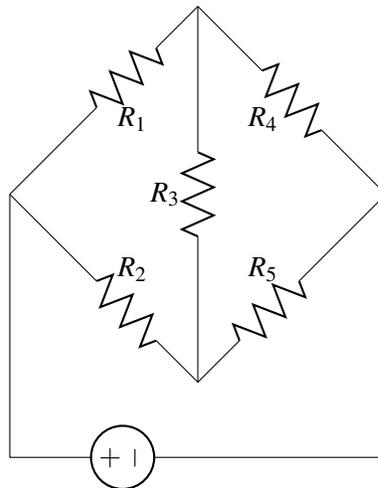
i.



ii.



iii.



- (a) Translate each of the circuits above into graphs.
- (b) For each graph, write the corresponding incidence matrix. What elements in the circuit are in series? What elements are in parallel?