1) Define the following:

Voltage: The difference in charge between two points.
Current: The rate at which charge is flowing.
Resistance: A material’s tendency to resist the flow of charge (current).

2) What is the equation that relates voltage, current and resistance?

\[ V = IR \]

3) Does the Arduino use AC or DC voltage?

DC

4) What is the equation for resistors in series?

\[ R_{tot} = R_1 + R_2 + \ldots + R_{N-1} + R_N \]

5) What is the equation for resistors in Parallel

\[ R_{tot} = \frac{R_1 \cdot R_2}{R_1 + R_2} \]
**Multimeters and Continuity**
https://learn.sparkfun.com/tutorials/how-to-use-a-multimeter?

Read the following sections:
- Introduction
- Parts of a Multimeter
- Measuring Voltage
- Measuring Resistance
- Measuring Current
- Continuity

6) What is continuity?
   A solid connection between two conductive points.

7) What is a typical symbol on a multimeter for continuity?

8) What is an example of when you might test for continuity?
   - Making sure a solder point is well attached.
   - Making sure that adjacent wires are not touching
   - Making sure that there is not a short circuit.
   - Figuring out what wires are connected to each other.

**Pull-up Resistors**
https://learn.sparkfun.com/tutorials/pull-up-resistors

9) What is a pull-up resistor?
   A pull-up or pull-down resistor is a resistor connected to an input pin on a micro-controller to ensure that the voltage is read as either high or low and not floating.
10) Draw a circuit for a pull-up resistor on a button input going into and input pin. Use the following symbols.

**Voltage Divider**
https://learn.sparkfun.com/tutorials/voltage-dividers

What is the equation that determines the relationship between voltage and resistance in a voltage divider?

\[
V_{out} = V_{in} \cdot \frac{R_2}{R_1 + R_2}
\]
Draw a diagram of a voltage divider:

![Voltage Divider Diagram](image)

**Schematics**
https://learn.sparkfun.com/tutorials/how-to-read-a-schematic

Draw the symbol for a resistor

![Resistor Symbol](image)

Draw a symbol for a variable resistor

![Variable Resistor Symbol](image)
Draw a symbol for a capacitor

Any of these:

Normal  Normal  Electrolytic  Variable

Draw a symbol for a switch

SW1

Draw a symbol for a battery

Draw a symbol for ground
Topics that Maybe should have been included
https://learn.sparkfun.com/tutorials/electric-power

Further Reading
https://ccrma.stanford.edu/courses/192a/Lecture1&2-Electronics.pdf
http://www.amazon.com/Make-Electronics-Discovery-Charles-Platt/dp/0596153740
http://www.allaboutcircuits.com/textbook/direct-current/
https://learn.sparkfun.com/tutorials/how-to-read-a-schematic

Other Interesting Things
https://learn.sparkfun.com/tutorials/e-textile-basics

If you want to learn about electronics:
1) Get ahold of something like this and go through it: http://www.amazon.com/Elenco-Electronic-Playground-Learning-Center/dp/B0035XSZDI/ref=sr_1_1?ie=UTF8&qid=1443035493&sr=8-1&keywords=electronics+learning

   We have 2 in the Max Lab

2) Get a kit and put it together: http://www.instructables.com/community/Best-Electronics-Kits-For-Adults/

3) Check out the various tutorials posted under Electronics Learning here:
   https://ccrma.stanford.edu/wp/250a/resources/