Equipment Required

Now grab your supplies!

- Gas Sensor
- Breakout Board
- Breadboard
- Header pins
- Arduino and Laptop
- Soldering Equipment (Soldering iron, solder paste)
- Resistors (4.7k, 10k, and 47kOhm)
- Potentiometer
- LEDs
- Candles and lighters for testing

Sensor Worksheet No. 1

Heater Timing

As we discussed before, the gas sensor must be heated up regularly to desorb any collected material and get good readings. We also have to make sure we are measuring the sensor resistance while it is cool. Refer to your sensor's datasheet for these timing intervals.
You will need to write code to turn on the heating system at these regular intervals. To turn on the heater, apply 5V to the timing control line (see the schematic for reference), and to turn off the heater, you will need to apply 0V. Discuss with your group how you want to write and test your timing code without hooking it up to the heating system or the gas sensor (to make sure it won't break!).

Sensitivity Resistor

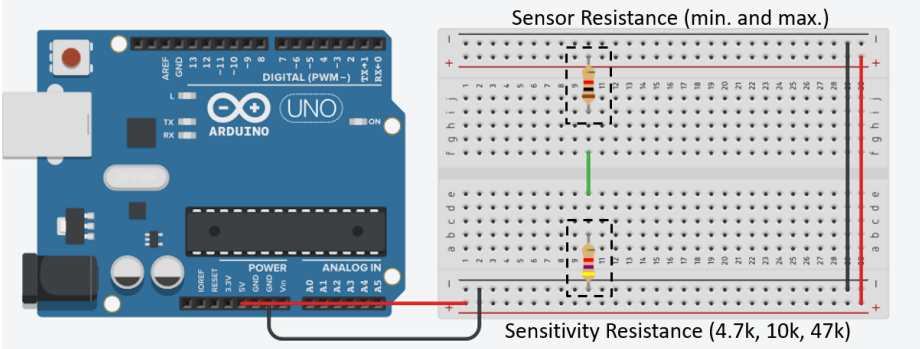
We want to choose the resistance that will give a **maximum change in voltage** across the sensitivity resistor for the range of the sensor resistance. To test this, we will replace the gas sensor with the expected gas resistance in the areas we are testing. Look at your data sheet:
For your testing locations, what is the minimum and maximum **sensor resistance** you expect to have?

Minimum Sensor Resistance (Rmin) _____

Maximum Sensor Resistance (Rmax) _____

Build the circuit below with your chosen sensor resistances and a sensitivity resistors. You will need to swap out resistors to test each combination of sensor resistance and sensitivity resistance. For each circuit, measure the voltage with a multimeter or the Arduino and fill out the table below.

Commented [1]: Swap resistors?



*This is called a **voltage divider** circuit, and we are using it to simulate the limits of our gas sensor.*

Sensitivity Resistor	Voltage for Rmin	Voltage for Rmax	Voltage Range
4.7k			
10k			
47k			

Based on these results, what value should your sensitivity resistor be?

Sensitivity Resistor (Rs) _____

Once you have chosen your sensitivity resistor, go build your gas circuit!

Hypothesis Specific Design

Now that you understand more about the sensor and its operation, think about the sensor's limitations and any environmental conditions that affect your hypothesis or how you collect your data.

What do you want to do with the data you collect, and is there any other data that might be important to write down when you collect it?

_____

_____

_____

What limitations or conditions might affect your gas sensor measurements?

_____

_____

_____

What other features do you want to implement in your circuit or code?

_____

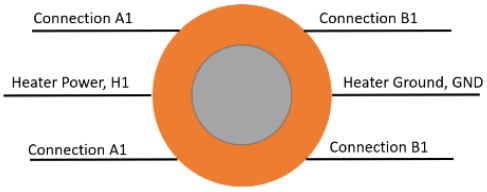
_____

_____

Share your thoughts with your group and circuits mentor, and make design changes!

Commented [2]: Encourage the students to think about what they want to do with their data: do they want to take an average at each site or collect over time? Do they want to add buttons for grabbing data or LEDs to shows when data is being collected?

MQ7 Carbon Monoxide (CO) Gas Sensor Data Sheet



Detection Range	10-500ppm
Normal Air Conditions	~0.1-1ppm | ~100ohm
Traffic	5-10ppm | 1kohm
Heater Timing	**90s** High Heat **60s** Low Heat (measure sensor resistance during this interval)
Sensitivity Resistor Range	1k-47kOhm (depending on operating conditions)

<add code reference>

Commented [3]: Find the exact values