

What changes in inhaled air vs. exhaled air?



Apparatus

CO₂ sensor
Large plastic bag

Optional

O₂ sensor

Data recording setup.

Select Start to begin, stop after duration.



The practical uses the CO₂ sensor or oxygen sensor or both to monitor the change in gas and humidity levels between inhaled air (the environment air) and exhaled air (a breath of air trapped in a bag).

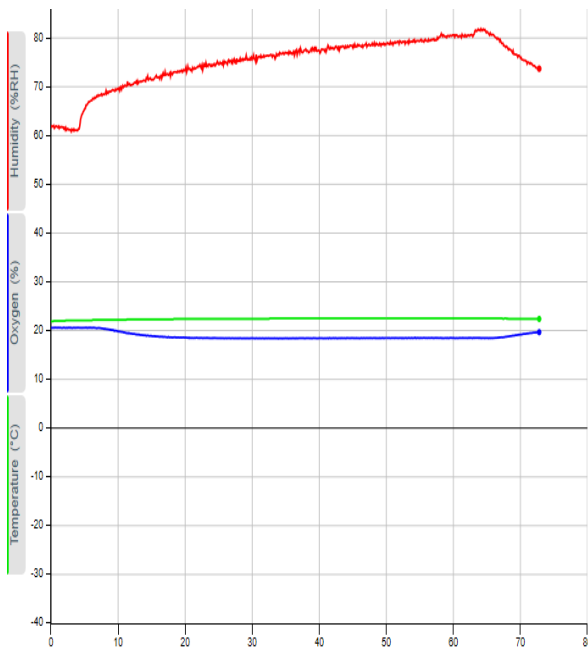
The Data Harvest gas sensors can measure temperature, pressure and humidity as well as the gas concentration they were designed for. The construction of the sensor means that the temperature, pressure and humidity values are not always directly comparable, we would advise that you only use the additional sensor ranges from one physical sensor.

Method

You will need a large plastic bag, something in the region of 2 litres+ to hold the air from a single exhaled breath. Paper bags can be used as an alternative.

For hygiene reasons allow one bag per person, a person can use the same bag for any extension work or repeats.

1. Turn on the sensor(s) and place them into the bag you have been give.
2. Connect the sensors you are using to the software, only use the humidity range from one of the sensors.
3. Select start to begin recording and record about 30 seconds of data.
4. Place your mouth to the opening in the bag and as you exhale breathe out into the bag. When you have finished exhaling close the bag using your hand to stop air leaving or entering the bag.
5. Collect data until the gas and humidity readings stop changing (this should be no more than a minute).
6. Open the bag, remove the sensors and leave them on the bench.
7. Wait for the gas to return to the start levels and stop the recording. The humidity may take longer to reach the start levels, it is a slower reacting sensor.

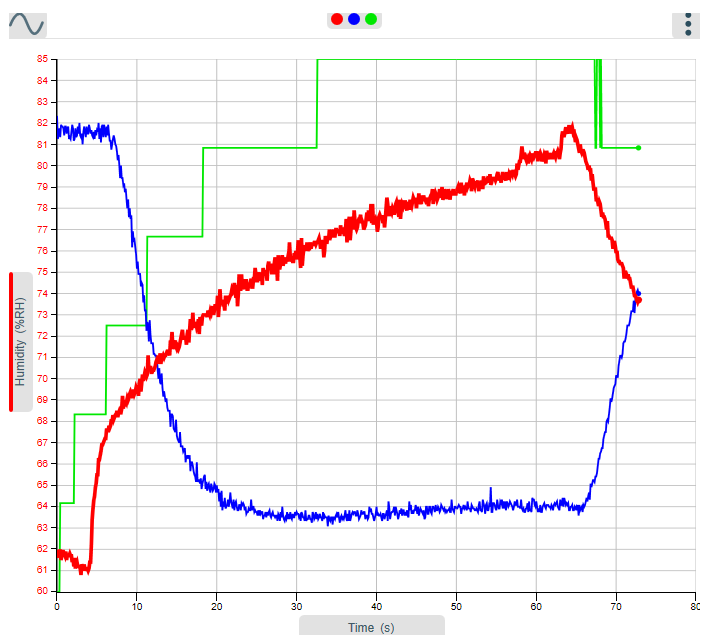


An example of collected data, this example used an oxygen sensor.

The data is as collected, scaling will be required.

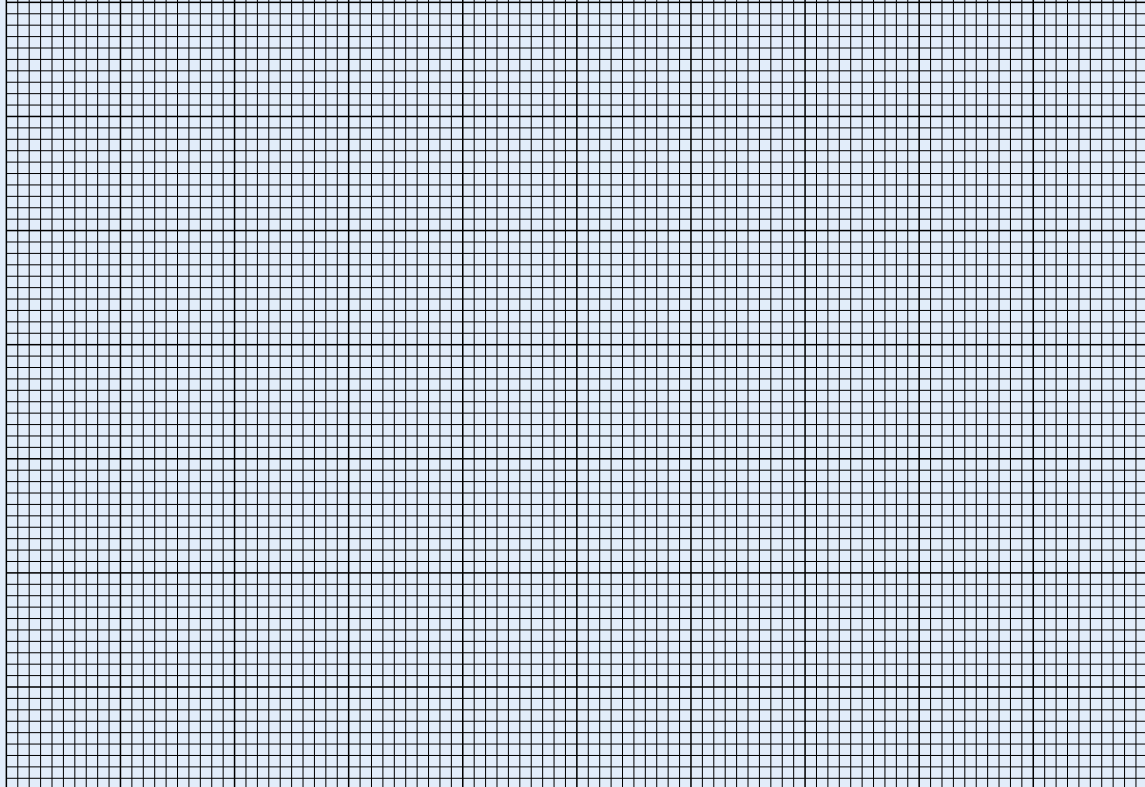
The same data after re-scaling user Min to Max (autoscale)

The data clearly shows a decrease in O₂ (blue) and an increase in humidity (red) and temperature (green). The temperature change was about 1 degree Celsius and the Min - Max scaling has made the data very steppy.



Questions.

If you have used only an oxygen or carbon dioxide sensor, sketch a graph to show what you think would happen to other gas and humidity in the same experiment.



1. Where does the carbon dioxide come from in the exhaled air?
2. What is the normal level of carbon dioxide in the air (as a percentage or ppm)?
3. Where does the water that changes humidity come from?
4. How else could you show that exhaled air contains water vapour?
5. What is the process in the body that uses oxygen and produces carbon dioxide?

Extension.

The apparatus once setup gives the potential for seeing what happens as you alter the inhalation / exhalation cycle.

1. Change the depth of the exhalation.
2. Use overlay and hold the breath for longer periods before exhaling into the bag.
3. See the effect of some exercise on how much or how quickly the gas levels change.
4. Use a carbon dioxide and oxygen sensor to see how their concentrations change.