

**databot™**  
**Sensor Starters**

 **Volatile Organic Compounds**

Meet the Air Quality Sensor



The Air Quality sensor senses CO2 and **volatile organic compounds (VOCs)** in the indoor air enabling you to test for air quality. The air we breathe provides oxygen and other essential components to fuel our cells and keep us healthy. If the air we breathe contains pollutants, toxic fumes, mold spores, or dangerous items like **volatile organic compounds (VOCs)**, it can harm our body.

What Does it Measure?

The **VOC** sensor measures the **VOC** levels in the air. **VOCs** are substances that evaporate at room temperature and can be harmful if you are exposed to high levels. Overexposure can lead to headaches, nausea, and irritation of the eyes, nose, and throat. Common sources of **VOCs** are cleaning solutions, paints, new carpets, and furniture.

*\*Exposure to even low levels of **VOCs** over a long period of time is also considered harmful.*

How Does it Work?

The **VOC** sensor has a sensing element known as a 'hot-plate' that senses metal oxide. The resistance of this 'hot-plate' varies with the reaction to an oxidizing gas, Ethanol. The higher the reaction, the higher the resistance! Based on this resistance level, a **VOC** value is calculated and output.

What Are the Units for VOC levels?

**VOC** levels are measured in **parts per billion (ppb)**. The term ppm expresses the **VOC** levels in a ratio of total parts **VOC** within a total of one billion parts. See the chart below for danger levels of **VOCs**!

Level	VOC (PPB)	Action
Low	0 - 250	No Action Required.
Moderate	250 - 2000	Sources should be identified and emissions should be reduced.
High	> 2000	Sources should be identified and require immediate ventilation of fresh air since it is very dangerous.

Important Terms

**Indoor Air Quality (IAC):** The quality of the air inside and nearby buildings that include humidity and gas levels.

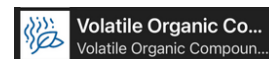
**Volatile Organic Compounds (VOCs):** Chemicals emitted by substances like cleaners, paint thinner, and paints.

**Off-Gassing:** The process of **VOC** production; as paint thinner evaporates at room temperature, it is "off-gassing" **VOCs**.

**Grades:** 6 & Up  
**Time:** 15 Minutes - PDQ 1 & 2  
**Subject:** Chemistry, Environment  
**Topics:** **VOC, Indoor Air Quality, ppb**

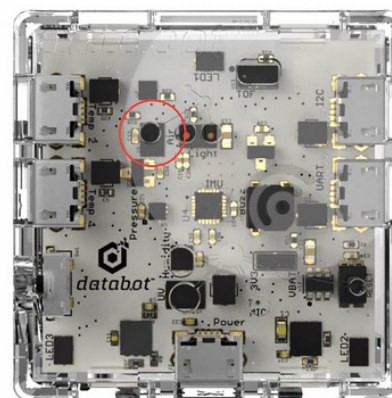
What You Will Need/Prep

- databot™ 2.0 & a smart device (iOS or Android).
- Read the Vizeey™ Fast Start Guide and install Vizeey™ if you haven't already.
- Scan the QR code for **Volatile Organic Compounds** if you haven't already.
- Glass container
- Vinegar





Where Does it Live?

The **VOC** sensor is a black rectangular chip with a circle on it. Look for the label "Air" near the Temp 2 port on the databot™ PCB. The large opening in the databot™ case provides air flow for the sensor to read correctly.



**PDQ1 : VOC Monitoring**

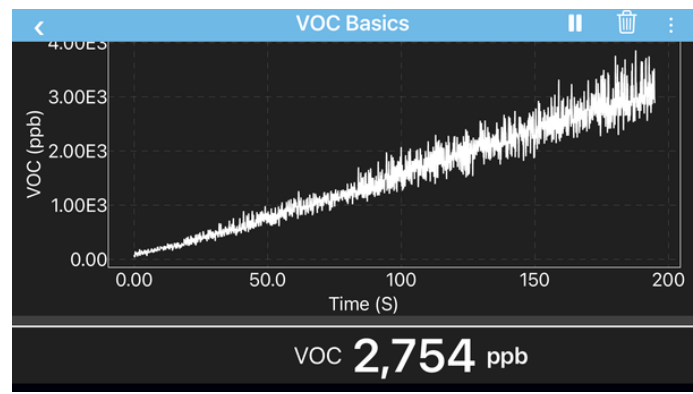
Using the databot™ VOC sensor it is possible to monitor the indoor air quality by detecting VOC levels. Your mission is to monitor the production of VOC levels from a common liquid, vinegar. Do you think you will find that vinegar off-gasses VOCs?

1. Tap on **Volatile Organic Compounds** in Vizeey™ to load the experiment and use these icons to start and pause the experiment: 
2. Place your databot™ in a glass container. Set the 1 cup of vinegar beside databot™ in the container. Seal the container to eliminate ventilation as shown.
3. Use the start icon  to record and watch the data! You can see the gradual increase in VOC levels.
4. Predict what you think would happen to the VOC level if you were to take off the top to your container.
5. When you feel the VOC level is constant, open the container to allow fresh air to circulate in it without pausing your display. Were you successful in your prediction?



← Seal the container to avoid ventilation that may interfere with your data!


← 1 Cup of vinegar + databot™ inside a container.

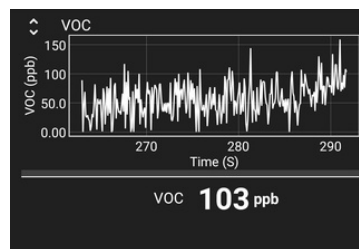


Emission of VOCs over time in Parts Per Billion

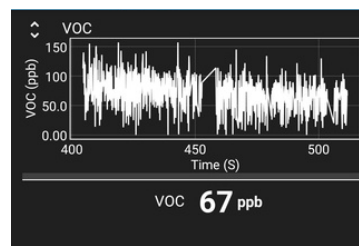
**PDQ2 : The Hunt for Wild VOCs!**

In PDQ 2 use the **Volatile Organic Compounds** experiment to identify five or more places that might be off-gassing VOCs. Your mission: create a data table that records VOC levels and locations. Let's check for possible indoor air quality danger!

1. Use your data table and brainstorm at least five locations where you think VOC levels might be high. For example, cleaning chemicals might be beneath the kitchen sink or chemical storage closet. New paint, furniture, or plastic toys may be off-gassing. Brainstorm a list of all the places these Wild VOCs may be hiding and impacting your indoor air quality!
2. Tap on **Volatile Organic Compounds** in Vizeey™ to load the experiment and use these icons to start and pause the experiment: 
3. Hold databot™ in the palm of your hand. Move to the various locations on your data table, and record all the VOC levels on your data table.
4. **Analysis:** Of the areas/objects tested which ones emit the highest level of VOCs? Are any of the levels you identified in the moderate or high areas? Develop and execute a plan to minimize VOCs as your data indicates.



VOC near cleaning solution



VOC in plastic toy

PBB	Location
103	Under kitchen sink.
67	Plastic toy.
	Living room carpet.
	Garage.
	Cleaning closet.

Example of a Data Table