Name: Date: Class:

# Student Data Sheet Answer Key

In groups of four, complete the activity below. Note: Share both the pollutant sources and Pods with other groups. After viewing the results as a class, answer the three questions at the end.

**SAFETY NOTES**

- Wear safety goggles.
- Tie hair back.
- Watch long sleeves.
- Take care not to inhale vapors from pollution sources.
- Be careful around any flames.

**Overview**

The objectives of this exercise are to:

1. Provide you with an opportunity to use the air quality monitors (Pods) and view the generated data.
2. Help you understand the connection between pollutants and potential sources.

**Materials**

- Pod air quality monitors; turn on 30 minutes before the activity for sensor warm-up
- Pollution sources, such as lighters, candles, coffee stir sticks, glue, rubbing alcohol, your own breath, and any other classroom sources that you suspect might release emissions
- Data Sheet (this worksheet)
- Computer and projector for plotting data (your teacher will do this after data collection is done)

**Procedure**

1. With your group, choose three pollution sources; write these items in the first column of the table.
   - These can be three different sources.
   - Or you may apply the same source in different ways, such as at different distances.
2. Write your predictions in the table in the “Expected Responses” column. In other words, list which sensors you expect to respond in each case.
   - Possible sensors are those detecting $CO_2$, CO, VOCs, PM, temperature and relative humidity (RH).
3. When a Pod is available, run your tests.
   - Hold the source close to the inlet, and a little below.
   - Spend at least 60 seconds on each test.
   - Make sure to wait 60 seconds in between each test to allow the sensors to adapt to the ambient air environment.
   - Record your start time and any observations, such as odors or smoke.
4. When each group is finished, your teacher will plot that data as a time series.
   - As a class, discuss which sensors responded to what sources and when.
   - Record the actual responses in the table in the final column; just list which sensors responded; not an amount or emission value.
5. Answer the Reflection Questions in your group. Use a separate sheet of paper for more space.

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**Data Collection**

| Source and Application Notes | Expected Response | Start Time | Observations | Actual Response |
|---|---|---|---|---|
| EXAMPLE burning coffee stir stick | EXAMPLE $CO_2$, RH | EXAMPLE 12:15 | EXAMPLE Heat while flame is lit; smoke when it is blown out | EXAMPLE $CO_2$, RH and VOC |
| Tea light candle | $CO_2$ and VOCs | 12:30 | Visible smoke when we blow it out, not when burning | $CO_2$ |
| Hand sanitizer | VOCs | 12:35 | Strong smell | VOCs |
| A marker | VOCs | 12:40 | Different smell; nearly as strong as before | VOCs |

**Reflection Questions**

1. How did your predictions match up with the actual responses? Give an example of one instance in which the two did not match up (for example, you did not predict a response, but it occurred), and an example of what you think happened.

   *Example answer:* Overall, it matched up well. We expected to see VOCs from the candle but did not. This may be an indication that the candle burns with more complete combustion than we expected, or all of the hydrocarbons are being combusted all the way to $CO_2$. Otherwise, all of our other predicted responses matched the actual responses.

2. Which source caused the biggest response from any of the sensors? Would you have expected it to cause this response, or was it a surprise? (Answer based on your group's data OR the entire class's data.)

   *Example answer:* The hand sanitizer caused a much larger response than the marker, which was a surprise because the marker smelled strongly. This may be explained by the sensor being more sensitive to the VOCs in the hand sanitizer and/or a larger amount of VOCs may have come from the sanitizer as a result of the container type.

3. How could measuring multiple pollutants in a city help researchers and regulators improve air quality? (*Example: Imagine you see $CO_2$ and VOCs vs. an instance in which you see no increase in $CO_2$, but measure VOCs. How would you explain the different causes for the two data sets*?)

   *Example answer:* Measuring multiple pollutants may help researchers figure out pollution sources. For example, if they are measuring a lot of $CO_2$ vs. $CO_2$ and VOCs, they look for sources that exhibit either more complete or more incomplete combustion, respectively. Alternately, if they are finding VOCs only, they might look for industrial sources in which volatilization occurs but not combustion.

4. What is a problem in your local community that you could use this air quality monitor to study? Explain the issue and how the monitor would help.

   *Example answer:* One example might be the impact of a highway. You could place the monitor next to the highway and monitor pollution levels over time, examining how they relate to day of the week and time of day (such as rush hour).