

Name:

Date:

Class:

## Example Research Plan: Indoor Air Quality

Use the following template to plan your project. Feel free to edit and reformat as needed.

### Group Members & Contact Info

Names, phone numbers, emails go here.

### Research Question or Hypothesis

Our school building is old and we are concerned about poor ventilation, particularly in the gym. Poor ventilation might affect our athletes' performance.

*Hypothesis:* Carbon dioxide levels will be higher during basketball games than during basketball practice because more people—more CO<sub>2</sub> sources—are in the gym.

*Research Question:* How do carbon dioxide levels in the gym compare during practice vs. during games?

What larger theme does this relate to? (For example, climate change, public health, etc.)

This project relates to public health, because elevated CO<sub>2</sub> concentration can make people tired and indicates poor ventilation, which means other pollutants may be accumulating indoors.

Who might be interested in this data? Why?

The athletes and coaches because players' performance might be effected. Those in charge of the school building may also like to know if the ventilation is not adequate or safe.

### Background Information

List what you *already* know:

High CO<sub>2</sub> levels indoors can make people sleepy and indicate poor ventilation.

List what you *need to* know:

What are typical CO<sub>2</sub> levels indoors and outdoors and what is considered "high." We also need to know the practice and game schedule in the gym in order to plan our sampling.

List your next steps:

We will download a copy of the schedule and do research online on CO<sub>2</sub> and indoor air quality.

### Method

What pollutants are you interested in?

Carbon dioxide

What additional quantitative or qualitative data do you need?

We also want to know more about the gym layout and ventilation so we can determine where to place the Pod. During sampling, we also want to collect/examine temperature and humidity data because this might shed light on the ventilation patterns as well.

What are you comparing? (For example, two pollutants in different locations, or the same location at different times.)

We are comparing CO<sub>2</sub> levels at the same location during two different events (a game vs. a practice).

### Required Materials

- 1-2 air quality monitors (Pods)
- Power cords
- Pencil and paper for field notes, to record usage times and other observations
- Cell phone to photograph sites and monitor setup

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### Procedure

How will you collect your data, step by step? This applies to groups using the Pods and groups using existing data.

- We will set up the Pod in the gym and leave it running for two weeks; this provides data during three games and six practices.
- Every three days we will check the monitor and download the data (to make sure it is functioning correctly).
- We will record any observations that might affect the experiment, including if the pod was moved or if anyone was observed tampering with it.

### Timeline

Project Phase	When will this happen?	What will we need?	Who will bring it? Or, how will we get it?	Questions?
Complete Project Plan	03/24/2016	Group to get together to finish writing plan	Group meeting after school on 03/23	
Prep Equipment	03/25/2016	Get Pod from teacher	Mike picks up Pod after school 03/25	
Collect Data	03/25/2016-04/09/2016	Group sets up Pod in the gym and checks data periodically	Rotate who checks on the Pod	
Check Data	04/12/2016	*Request assistance	In class with teacher	
2 <sup>nd</sup> Data Collection (if necessary)	04/15/2016	TBD		
Data Analysis	04/24/2016	In class, use Excel to make CO <sub>2</sub> averages, charts and graphs	In class	How will we know what is "good" data? And, what days to use?
Make Poster	04/28/2016	Laptop, PowerPoint template and our data	In class	
Symposium	5/5/2016	Poster and prepared 2-5 minute talk	University student mentor prints and brings poster	How should we dress?

### Potential Sources of Error

List two potential sources of error and how you can minimize their effects on the data.

1. Error due to sensor malfunction: We will check our data periodically during collection to make sure the sensor is working and the Pod is recording data for the entire sampling period.
2. Pods inadvertently blocked during a game if the gym is crowded: Place the Pod up higher and out of the way to make sure it always has the same ability to sample.

### Data Analysis Plan

Describe two statistics that you will compute to help you evaluate your hypothesis.

- We will compare the average CO<sub>2</sub> during practices vs. during games.
- We will also compare the peak CO<sub>2</sub> concentrations for games vs. practices.

Describe two plots that you will make to help you evaluate your hypothesis.

- We will plot time series of the CO<sub>2</sub> levels at each site to make a visual comparison and look for patterns.
- We can use a bar chart to visually compare the statistics listed in the previous section.