

# Intro to IAQ Stations

# Station 1: Temperature and Student Learning

- **Examine the graphs and their captions from a scientific journal article.**
- **Write one-two sentences about each graph (Fig 1 and 2).**
- **Then write a claim that is supported by these graphs.**
- **Both graphs are from the article:** Wargoeki, P., Porrás-Salazar, J. A., & Contreras-Espinoza, S. (2019). The relationship between classroom temperature and children's performance in school. *Building and Environment*, 157, 197-204.

# Figure 1

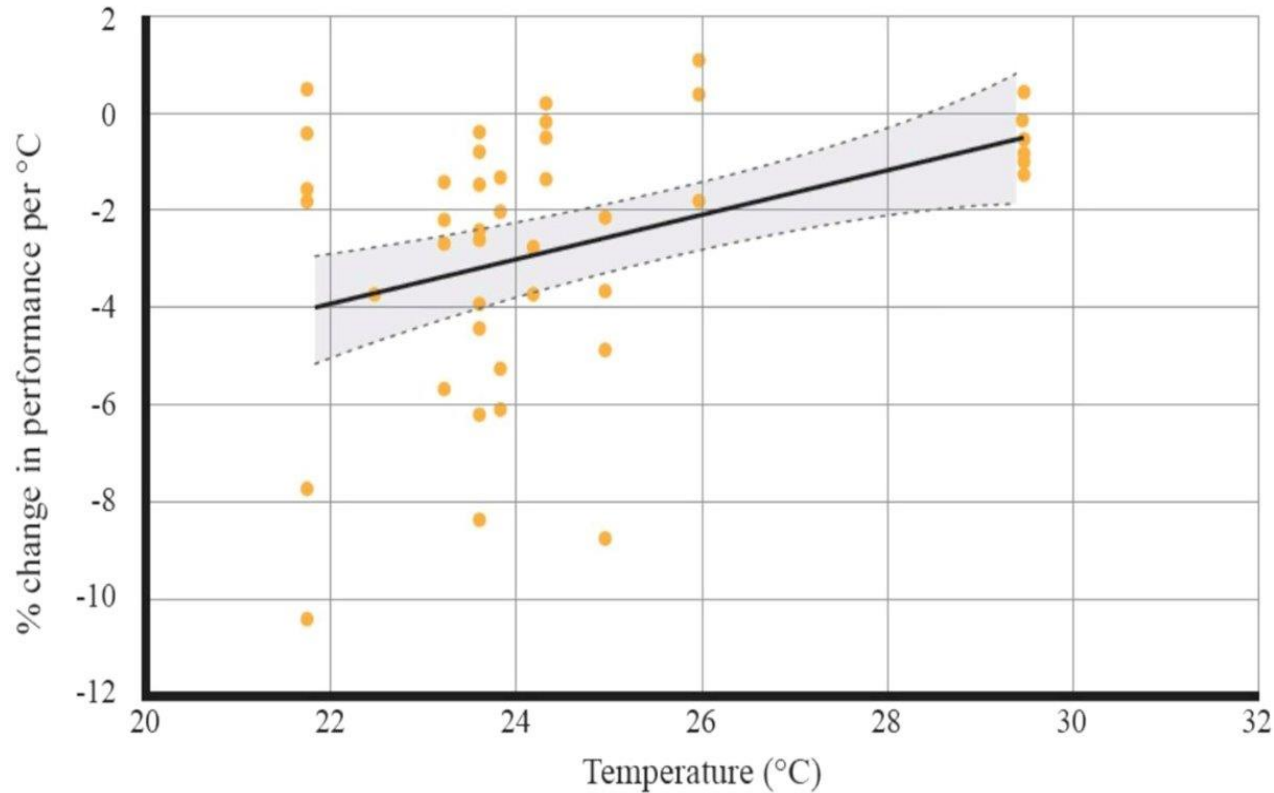
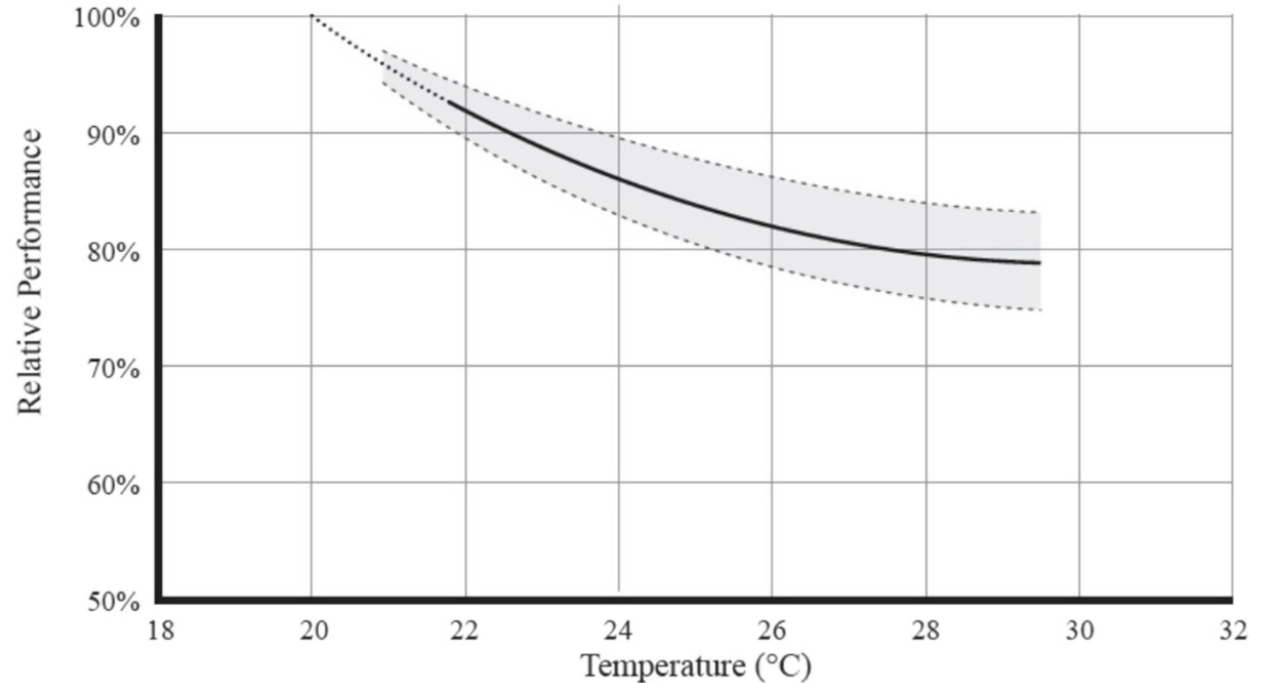


Fig. 1: The fractional change in performance per 1 degree Celsius change in temperature at the midrange plotted against average temperature for the range for which the fractional change was calculated. The data is for speed at which the tests were performed. Negative values indicate reduced performance with increased temperature. The lines show the regression (solid line) with 95% confidence bands (dashed lines). Dots show the estimated midrange for individual tests or tasks (see Table A.1 in Supplementary Material). The function describing relationship between percentage change in performance and temperature is as follows:  $y=0.4596t-14.086$ ; where  $t$  is the air temperature.  $R^2=0.19$ ;  $P<0.001$ .

## Figure 2

Fig.2. Performance of schoolwork as a function of classroom temperature. Performance is the speed at which tasks or tests were performed. The lines show the relationship derived from the curve in Fig. 1 (solid line), with the 5th (top) and the 95th (bottom) percentiles (dashed line) considered to represent the 95 confidence interval. 100% has been set arbitrarily at 20°C (see text) and is considered optimal performance. The function describing relationship between relative performance and temperature is as follows  $y=0.2269t^2 - 13.441t+277.84$ ; where  $t$  is the air temperature.



# Station 2: Engineering Design

- Read this [EPA infographic](#)
- Define the problem presented in the infographic.
- Brainstorm at least three possible solutions.
- In order to engineer a solution for our classroom, we need to know the criteria (requirements) and constraints (restrictions or limitations). Suggest at least three criteria and three constraints for a solution to the problem.

# Station 3: Air Quality and Human Health

Watch [American Lung Association video](#).

Write:

- 3 things you learned
- 2 questions you have
- 1 emotion or reaction to this video

# Station 4: Asking Testable Questions

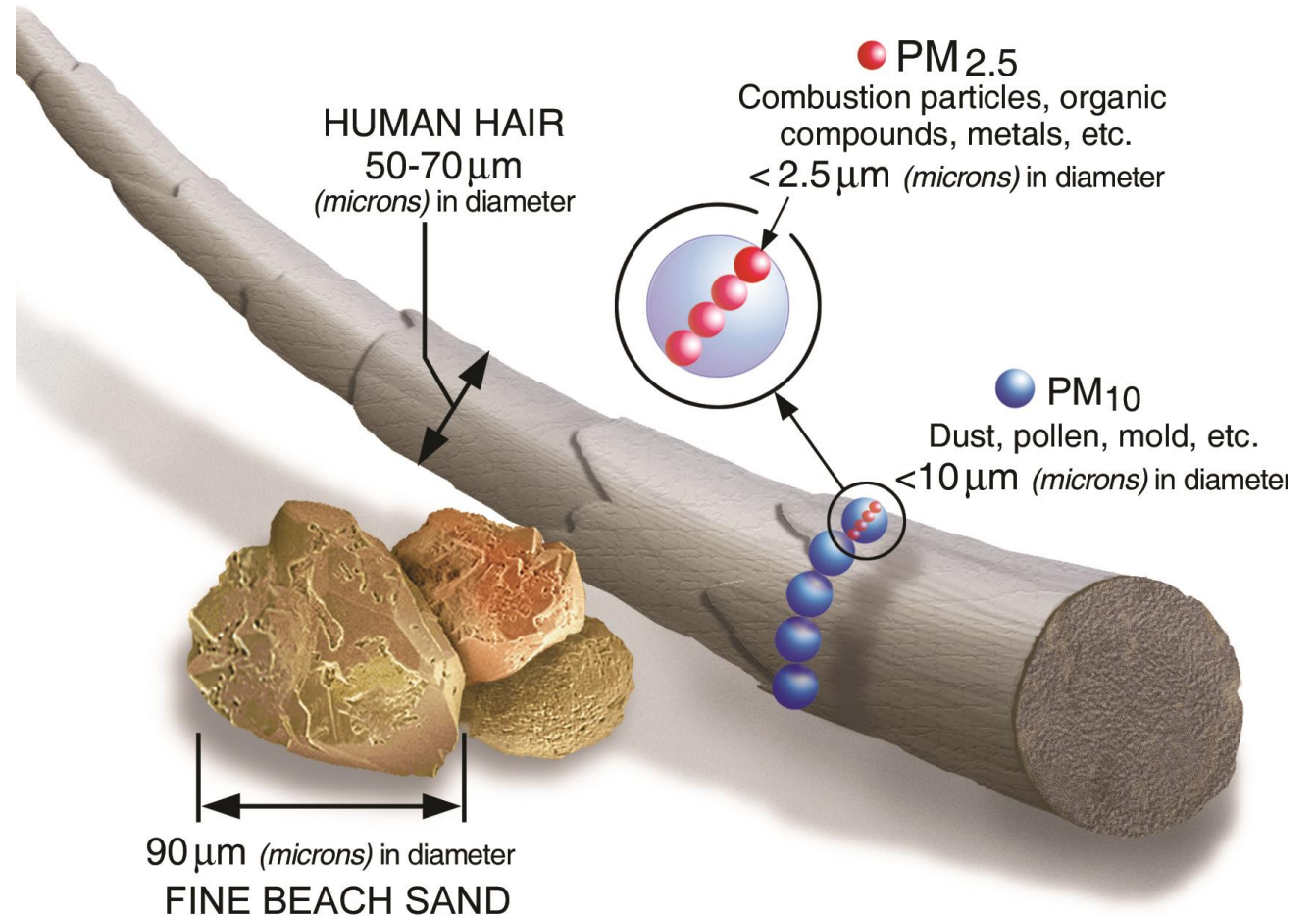
- Read about the Air Quality Index (AQI) and particulate matter (PM)
- Write testable questions and hypotheses relating to Air Quality Index and/or particulate matter.

# Particulate Matter

PM stands for particulate matter (also called particle pollution): the term for a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, soot, or smoke, are large or dark enough to be seen with the naked eye. Others are so small they can only be detected using an electron microscope.

Particle pollution includes:

- **PM<sub>10</sub>**: inhalable particles, with diameters that are generally 10 micrometers and smaller; and
- **PM<sub>2.5</sub>**: fine inhalable particles, with diameters that are generally 2.5 micrometers and smaller.
  - How small is 2.5 micrometers? Think about a single hair from your head. The average human hair is about 70 micrometers in diameter – making it 30 times larger than the largest fine particle.



# Air Quality Index

The Air Quality Index, or AQI, is the system used to warn the public when air pollution is dangerous. The AQI tracks ozone (smog) and particulate matter (tiny particles from smoke, power plants and factories, vehicle exhaust, and other sources), as well as four other widespread air pollutants. Newspapers, radio, television, and websites report AQI levels year-round. Keeping track of the current air quality information in your area can help you take steps to protect yourself, children, and others from unhealthy levels of air pollution.

Index Value	Name	Color	Advisory
0 to 50	Good	Green	None
51 to 100	Moderate	Yellow	Unusually sensitive individuals should consider limiting prolonged outdoor exertion
101 to 150	Unhealthy for Sensitive Groups	Orange	Children, active adults, and people with respiratory disease, such as asthma, should limit prolonged outdoor exertion
151 to 200	Unhealthy	Red	Children, active adults, and people with respiratory disease, such as asthma, should avoid prolonged outdoor exertion; everyone else should limit prolonged outdoor exertion
201 to 300	Very Unhealthy	Purple	Children, active adults, and people with respiratory disease, such as asthma, should avoid outdoor exertion; everyone else should limit outdoor exertion
301-500	Hazardous	Maroon	Everyone should avoid all physical activity outdoors.

## Station 5: Analyzing Data

How does particulate matter affect students' math test scores?

### Graph from

Lam, P. H., Zang, E., Chen, D., Liu, R., & Chen, K. (2023). Long-term exposure to fine particulate matter and academic performance among children in North Carolina. *JAMA Network Open*, 6(10), e2340928-e2340928.

