

Title	Air As a Mixture: Examining the Constituents of Air and How They Impact Our Health	
Next Generation Science Standards	HS-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.	Students will use the Plume Lab's flow device to measure the concentration of NO₂ in the air and discuss factors which can increase the rate of photochemical smog reactions that produce it. A great resource is the EPA information sheet on the production of photochemical smog which includes the chain of involved chemical reactions and how factors such as temperature impact the process (EPA Information, 2004).
	HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.	Students will research and categorize the different sizes of Particulate Matter (PM) currently identified and use the Plume Lab's flow device to measure the concentration of such pollutants in the air. Students will elaborate on the implications such pollutants have on respiratory health by comparing particulate size to lung tissue and evaluating if penetration is possible. Students will pose possible solutions such as wearing masks and what material would most effectively guard consumers from PM pollutants.
5E Phase	Engage	Invite students to do a "word dump" or verbally share what they already know about air pollution and environmental justice. An innovative method of executing this practice could be start a word cloud by asking students to share their responses on an electronic poll hosted by polleverywhere.com
	Explore	Have students asset map their communities using Google Maps. Direct them to list the green spaces, factories, wastewater purification facilities, highways, residential areas, schools, grocery areas, etc. Based on the mapped facilities, have students hypothesize pollution levels and types of the various sectors.
	Explain	Provide students with the Plume Lab's flow device to gather data from their communities. If resources are scarce, teachers may collect data themselves from the locations that students specify and then share that data with their students. Have students examine the VOC, NO₂, PM₁₀, and PM_{2.5} levels for the various areas data was collected on. Students should evaluate their

		hypothesis based on how the data compares to it. Students try to come up with explanations for the data by referring to their asset maps. What facilities could be causing the different types of pollutions? To aid this process, present chemical reactions that occur which increase VOC and NO₂ productions. Students must consider how factors like temperature or elevation (air pressure) can impact pollution. Based on their findings, students will brainstorm solutions to help minimize exposure. Some ideas may be masks (specify material), planting trees, building public transportation, etc. Pros and cons of each solution must be included.
	Elaborate	Students evaluate their assumptions and weigh it against the data. For example, they may have thought that richer areas of town would have less pollution but that didn't actually turn out to be the case, as was the case in São Paulo (FinancialTimesVideos, 2019). Or they assumed that greener areas must be low on pollution but came to realize certain types of pollution remain high in concentration. Students can also compare how their city's data compares to other cities and investigate what policies other cities may be adopting to improve air quality.
	Evaluate	Students present their findings and discuss implications to the rest of class in a presentation format to receive feedback from peers.