

Air Pollution and Art, part 1

A 6th grade STEM lesson

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Notes for teachers

This lesson provides context for the 6th grade physical science standards dealing with matter. It enables students to anchor their learning in real world issues.

Students build on this knowledge in the following lesson, Air Pollution and Art, part 2.

List of Materials

- slide deck and ability to display for students
- devices for students to access the internet (could be in pairs)
- air pollution sources notetaker (copies for students)
- air pollution sources info cut into strips (each pollutant on a separate strip without the name of the pollutant)
- completed air pollutions grids (per pair of students)
- whiteboards and dry erase markers (per student or per small group; could use virtual version or plickers)

Standards

1.a Ask questions that arise from careful observation of phenomena, models, or unexpected results.

1.b Ask questions to clarify or identify evidence and the premise(s) of an argument.

6 e Apply scientific knowledge and evidence to explain real-world phenomena, examples, or events.

Standards

6.P1U1.3 Develop and use models to represent that matter is made up of smaller particles called atoms.



Objective(s):

Today I will:

- interpret air quality data.
- research the 6 criteria pollutants to identify sources, health, and environmental effects.

Agenda (70 minutes)

- slow reveal graph (warm up)
- video (whole class)

- research criteria pollutants (in pairs)
- game (whole group)



Intro/Driving Question/Opening

Slow reveal graph of Most Polluted Cities in America

What surprises you?

What questions do you have?

Share video:

Warm up: study the graph.

Make at least two observations.



What new information do you have?

What do you think this graph might be showing?



What questions do you have?

What do you think the line (marked by a red arrow) represents?

The Most Polluted Cities In America

Cities with the highest year-round levels of particle pollution in the U.S. (2017-2019)*



The Most Polluted Cities In America

Cities with the highest year-round levels of particle pollution in the U.S. (2017-2019)*

National Standard for PM2.5 (higher than 12.1 is a fail)



How do we know if our air is safe to breathe?

What makes air polluted?

Video

Watch and discuss:

What information do we have now?



Hands-on Activity Instructions

- Students research criteria pollutants using the provided internet resources:
 - <u>https://flexbooks.ck12.org/cbook/ck-12-middle-school-earth-science-flexbook-2.0/section/10.19/primary/lesson/types-of-air-pollution-ms-es/</u>
 - O <u>https://www.ducksters.com/science/environment/air_pollution.ph</u> <u>p</u>
 - O <u>https://www.youtube.com/watch?v=gEdAaKHnof8&t=2s</u>
- Pairs of students match the information on paper strips(Description, Sources, and Signs/Effects) with each Pollutant.

Air Pollution Sources Major Man-Made Air Pollutants

Pollutant	Description	Sources	Signs/Effects
Carbon monoxide (CO)			
Lead (Pb)			
Nitrogen oxides (NOx)			
Ozone (O3)			
Particulate Matter			
Sulphur dioxide (SO2)			

Air Pollution Sources

Major Man-Made Air Pollutants

Pollutant	Description	Sources	Signs/Effects
Carbon monoxide (CO)	 colorless, odorless gas 	 vehicles burning gasoline indoor sources, including kerosene, wood-burning, natural gas, coal, or wood- burning stoves and heaters 	 headaches, reduced mental alertness, death heart damage
Lead (Pb)	 metallic element 	 vehicles burning leaded gasoline metal refineries lead paint 	 brain and kidney damage contaminated crops and livestock
Nitrogen oxides (NO _x)	 gaseous compounds made up of nitrogen and oxygen 	 vehicles power plants burning fossil fuels coal-burning stoves 	 lung damage react in atmosphere to form acid rain deteriorate buildings and statues damage forests form ozone & other pollutants (smog)
Ozone (O ₃)	 gaseous pollutant 	 vehicle exhaust and certain other fumes formed from other air pollutants in the presence of sunlight 	 lung damage eye irritation respiratory tract problems damages vegetation smog
Particulate matter	 very small particles of soot, dust, or other matter, including tiny droplets of liquid 	 diesel engines power plants industries windblown dust wood stoves 	 lung damage eye irritation damages crops reduces visibility discolors buildings and statues
Sulphur dioxide (SO ₂)	 gaseous compound made up of sulphur and oxygen 	 coal-burning power plants and industries coal-burning stoves refineries 	 eye irritation lung damage kills aquatic life reacts in atmosphere to form acid rain damages forests deteriorates buildings and statues

Cut this page into 6 strips across so that the information for each pollutant is on one strip, **but not the name of the pollutant** (first column).

Give each pair of students one set and one blank grid.

When they think they have them all in the right places, either check their work or give them a completed grid to check for themselves.



Assessment

Game: identify each pollutant using the notes from your research.

Students can play as individuals, pairs, or table teams.

Students use their completed grids as reference.

Display each image and give students time to identify which of the 6 criteria pollutants is being described. Some have more than one pollutant.

Correct answer(s) displayed on click.

Choosing fuel for your family vehicle



CO, Pb, Nox, O3

Leaving your computer on



Electricity from a coal-fired electrical plant gives off SOx, NOx, and Lead (Pb).

Using lights to read



Electricity from a coal-fired electrical plant gives off SOx, NOx, and Lead (Pb).

Burning leaves or trash



Particulates are produced.

Not maintaining your vehicle



Vehicles' exhaust gives off SOx, NOx, and CO.

Living close to an animal feeding operation



Particulates are produced.

Not maintaining your furnace



Improperly maintained furnace promotes incomplete combustion and the production of CO.

Riding your bike on a gravel street or road



Fugitive dust (both PM2.5 and PM10 particulates) is stirred up.

Differentiation

Remediation

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Students can be given a partially filled in grid, or the entirely filled in grid, and use it to participate in the game.

Extension/Enrichment

Criteria Pollutants readers theater play:

https://uni.edu/storm/downloads/middleschool/Criteria%20Pollutants%20final%2 Oupdate.pdf Lesson created with the support of the Arizona STEM Acceleration Project



Arizona STEM
Acceleration Project