

## Middle School Lesson Suggestions (Grades 6-8)

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### Essential Questions

- How do individual actions affecting the environment impact the community?
- When does knowledge lead to positive change?

### Outcomes

- Students will be able to identify chemical compounds in car emissions.
- Students will be able to explain the connection between car emissions, air quality and health.
- Students will inquire, research, and draw conclusions on the subject.
- Students will share findings orally and in writing.
- (for CASEO) Students will analyze idling habits in their community, collect and interpret data, chart data, and take action to reduce idling in their community.

### Common Core State Standards, ELA: Science & Technical Subjects

- [CCSS.ELA-Literacy.RST.6-8.1](#) Cite specific textual evidence to support analysis of science and technical texts.
- [CCSS.ELA-Literacy.RST.6-8.2](#) Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
- [CCSS.ELA-Literacy.RST.6-8.3](#) Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- [CCSS.ELA-Literacy.RST.6-8.10](#) By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently.

### Service Learning Components

The CASEO program meets all of the following Service Learning standards: meaningful service, youth voice, link to curriculum, reflection, progress monitoring, duration & intensity. (For more information on standards, see <http://www.nylc.org/k-12-service-learning-standards-quality-practice>.)

### Materials & Preparation

- Review Inquire, Investigate and Act sections of the lesson
- Review and acquire sources from Suggested Reading List as needed
- Prepare “Dirty sock” for pollution investigation. For instructions see <http://bit.ly/1bjLozO>
- Set up centers as needed for each of the data sources and investigations
- Prepare Chart Paper T-charts labeled: “Facts | Thoughts” for each team
- Provide sticky notes for student T-charts
- Provide drinking straws to use in “Burpees & Breathing” experiment. After one minute of cardio exercise, students plug nose and try to breath through small straw – replicating restricted airflow during an asthma attack.
- Magnifying glasses

## Vocabulary

air quality, air quality index, asthma, carbon emissions, carbon monoxide, idling, nitrogen oxide, particulate matter, pollution, volatile organic compounds (VOCs)

Activities

### Inquire (1 class period)

Engage students by asking them what they already know about idling, air quality and the connection to their health. Share vocabulary words with class. Chart what students would like to know and what they expect to learn about idling. Questions might include: What chemicals are emitted when a car idles? Why does it matter? How is air quality measured? What is particulate matter? What solutions can mitigate carbon emissions? Is our air quality good? etc.

Encourage students and parents to participate in The Clean Air for Schools: Engines Off program (CASEO) if they are interested.

### Investigate & Analyze (1-2 class periods)

Summarize student-driven questions and students' prior knowledge. Post. Break students into teams to seek relevant answers to their questions using any of the following resources. Ask each team to record "Facts" & "Thoughts" with sticky notes on a large t-chart, as they investigate:

- (internet only) **Smog City** Students experiment with the air quality variables in the game Pollution Game Smog City 2 <http://www.smogcity2.org/smogcity.cfm?preset=particle>
- (internet only) **Particle Matter** Students view short animation of scientific explanation of pollution <http://www.epa.gov/airnow/pm/pm.html>
- (print or internet) **Pollutants** Students examine a microscopic view of air pollutants [http://www.teachengineering.org/collection/cub/\\_lessons/cub\\_air/cub\\_air\\_lesson02\\_pollutants.pdf](http://www.teachengineering.org/collection/cub/_lessons/cub_air/cub_air_lesson02_pollutants.pdf) and 6 Most Common Air Pollutants <http://www.epa.gov/airquality/urbanair/>
- (print or internet) **Car Emissions** Students explore: How Much Air Pollution Comes from Cars? and How do Catalytic Converters Work? <http://auto.howstuffworks.com/air-pollution-from-cars.htm> & <http://auto.howstuffworks.com/catalytic-converter.htm>
- (print or internet) **Infographics** Students review graphics and information on Air Pollution Bulletin Board <http://bit.ly/1g6SNZC>
- (lab setting) **Dirty Sock?** Students speculate source of "dirt" on the dirty sock using a magnifying glass. (*source: teachengineering.org "You've Got to See It to Believe It" lesson*)
- (open space setting) **Burpees & Breathing** Students do burpees or other stationary cardio exercises at full speed for 30 seconds. After completing the exercise, students "experience" the restriction of airflow during an asthma attack, by breathing through a straw while plugging nose.
- (reading nook setting) **Fact Finders** Students utilize books from suggested reading list (or similar books, such as relevant science texts) to answer student-driven questions.
- (handouts) "Children Breathing" and "CASEO Air Quality"
- (newspaper or internet) **AQI Index** [http://www.airnow.gov/index.cfm?action=airnow.local\\_city&zipcode=80210&submit=Go](http://www.airnow.gov/index.cfm?action=airnow.local_city&zipcode=80210&submit=Go) Students enter zip code of school to track air quality (or use weather section of local newspaper.)
- (interviews) **Guest Speakers** Students interview school nurse about environmentally triggered asthma, asthma rates of the school, etc. And/or, students interview fellow students with asthma (if they are willing to share.)

## **Act** (Time Varies)

Ask student teams to share their most impactful research findings. How do their findings compare to their prior knowledge? Write the words, "Now what?" on the board. Now that students have investigated the harmful effects of carbon emissions on air quality and health, are they concerned about the effects of poor air quality on their own health? Are they concerned for their friends with asthma? Do they feel compelled to take action? Encourage students to act in a way that makes sense to them. Students could:

- Participate in the CASEO program
- Provide a written summary of their findings
- Videotape a public service announcement to share with their school
- Create community posters to discourage idling
- Provide parents with an email, text or letter with data on idling and the harmful affects on their child's health
- Create an incentive for parents to park and get out of the car – such as a comfortable bench, beautiful flowers, or a wall of student work
- Additional student-driven ideas

If students are Carbon Crunchers in the CASEO program, they can utilize the scientific method to hypothesize, experiment, and track and analyze data found regarding idling at their school. Students can also chart and make a graphic representation of the data to share with the entire school community.

## **Extension**

Invite school district and local officials to come to speak on their roles and responsibilities in promoting good air quality for students.