



Lesson Plan

Grade/Subject 8th grade Science

Title

Core: 8.4.3

Idle Effects

Standard/Objective.

8.4.2 Engage in argument supported by evidence about the effect of per capita consumption of natural resources on Earth's systems. Emphasize that these resources are limited and may be non-renewable. Examples of evidence include rates of consumption of food and natural resources such as freshwater, minerals, and energy sources.

Cross Cutting Concept: Cause and Effect

Cause and effect relationships may be used to predict the effects of per capita consumption of fossil fuels on Earth's atmosphere.

Lesson Performance Expectations (description):

Students will collect data on the amount of time cars spend idling. They will use the data to calculate the effect of per capita consumption of gasoline on Earth's atmospheric system by calculating how much idling costs in fuel consumption, carbon [dioxide] emission, and air pollutants. Calculations will be used as evidence to engage in argument about the effect of per capita consumption of fossil fuel on Earth's atmospheric system.

Materials: Internet access, computers if possible

Worksheets, Slide presentation and data collections sheets listed in Teacher Resources

Time: 2 45 minute class periods

Teacher Background Information: Many Utah communities are situated in bowl-shaped basins cradled by majestic mountain ranges on the east and west sides. These growing metropolitan areas use more and more fossil fuels which generate an increasingly significant amount of air pollution which the bowl-shaped valleys collect and concentrates. Communities that are not located in bowl-shaped valleys are also affected by problems associated with fossil fuel consumption. The problems span the seasons; ozone threatens health in the summer months and particulate matter (PM) is a winter hazard. The pollution is particularly harmful to children. Data shows that child hospitalizations increase following episodes of poor air quality. Vehicles are the primary source of precursor emissions for PM_{2.5} pollutants and ozone pollution. Idling engines contribute significantly (and unnecessarily) to air pollution, especially right around drive-throughs and pick up/drop-off areas. Idling a vehicle for more

than 10 seconds wastes fuel. Idling cars waste .5 to 1 gallon of fuel per hour and 20 pounds of carbon dioxide are released into the atmosphere with each gallon burned.

Student Background: Fossil fuels are a nonrenewable resource. Air, like fresh water supply, is a resource that can be impacted. .

Student Performance

Phenomenon: *Observation of event, data or other evidence of activity.*

Students look at photo of air pollution and fill in Phenomenon One portion of Idle Effects student worksheet.

<https://docs.google.com/document/d/13YhYLOPp3TD26ruFdLAWXEmr4QV4bnMjoG6nWWT0Xlc/edit?usp=sharing>



(EPA photo)

Answer questions:

1. What do you observe in the photo?
2. What questions do you have?
3. How do you explain what is happening?

Gathering: (Obtain Information, Ask Questions/Define Problems, Plan & Carry Out Investigations, Use Models to Gather Data and Information, Use Mathematics/Computational Thinking.)

DAY ONE

1. Invite students to share what they already know about air pollution.
2. Make a list of sources of air pollution
3. Show What's Up with Our Air Google Slide presentation (Breathe Utah)
<https://docs.google.com/presentation/d/1lVdtcWvsdfFKESe5kowM8NBGFhCuVa-EfZC4p7nUIBs/edit?usp=sharing> [NOTE: There are presentation notes for the teacher at the bottom of the screen.]
4. Idling engines contribute significantly (and unnecessarily) to air pollution.
5. Ask students "How much do we contribute to pollution by idling?"
6. Give homework assignment to collect data about family idling habits. Use the Idle Observation and Evaluation Form
https://docs.google.com/document/d/1UH_Lt53MPBoFQw1MBvIGQL873fiybYUzmHtILJYIDcc/edit?usp=sharing [NOTE: You can copy this double sided and have student only fill out observation side or copy in two sheets, giving students the first sheet the first day and the second sheet on day 2.]
7. Homework may take one of the following formats:
 - a. Keep track of how much time family car idles over the next 24 hours
 - b. Record idling behaviors at school during drop-off and pick-up times
 - c. Record idling behaviors for a specified amount of time at bank drive through or restaurant drive through

Reasoning: (Evaluate Information, Analyze Data, Use Mathematics/Computational Thinking, Construct Explanations/Solve Problems, Develop Arguments from Evidence, Use Models to Predict & Develop Evidence.)

DAY TWO

1. As an attention getter, give students the Idle Quiz, either in Kahoot or written form.

Kahoot: <https://play.kahoot.it/#/k/b52df675-bfa9-4302-b8a1-1694e05cfc51>

Written:

<https://docs.google.com/document/d/1z2gvtEaAAU2UUaQtuqnrvxk8oIKBpbvJ2rouPhcQdE/edit?usp=sharing>

Quiz Answers and Explanations:

<https://docs.google.com/document/d/1-4BGlt4SK3mZZ1-Blsb52KfYHvk-5X6gOdKRY58ISks/edit?usp=sharing>

2. Calculate the cost in gallons of gas, money wasted, and carbon dioxide emitted. The Idling: Analyzing the Data sheet can be used to explain how to analyze the data if needed.

https://docs.google.com/document/d/19x5OgsOn5xhOgl1FOYqtk77e_F2fu6N4DrTCOt2da6o/edit?usp=sharing

3. Fill out page 2 of the Idle Observation and Evaluation form

Communicating: (Communicate Information, Argue from Evidence (written & oral), Use Models to Communicate).

4. Invite students to share results of their idling survey (Google Sheets, Google Forms, write data on board, share in pairs, or.....)
5. In partners or as a class, discuss and summarize the results. Include in the discussion the following information:
 - a. Idling uses fossil fuels.
 - b. Fossil fuels are a nonrenewable natural resource.
 - c. Burning fossil fuels adds ingredients to the atmosphere that contribute to ozone and PM2.5 pollution as well as global climate change.
 - d. Per capita means per person.
 - e. Per capita consumption of a natural resource refers to the average personal use of a resource per person.
 - f. The consumption of natural resources affects Earth's systems.
 - g. The per capita consumption of fossil fuels used while idling affects Earth's atmosphere.
6. Free Write. Refer students to Idle Effects student worksheet (given on Day 1) and instruct them to silently spend the next few minutes writing a response to the following prompt: Use evidence to describe the per capita effect of idling on Utah's atmosphere.
7. Use the picture below as the concluding phenomenon. On the Idle Effects student worksheet, have students answer the follow questions about the photo:
 - a. How has your understanding changed?
 - b. Can you think of another phenomenon that applies to these concepts?
 - c. Explain what is going on based on what you have learned.



Teacher Resources:

Idle Pre- and Post Quiz

https://docs.google.com/document/d/1f4DfAXKoZQ3hqGboe4J_MnVW4cJDZ68aeKYySnPkjMc/edit?usp=sharing

Idle Pre and Post Quiz KEY

https://docs.google.com/document/d/1kZSSXf9JKp-9HP-2Q7_mWCAOemvJqh_loMQkCN-esqs/edit?usp=sharing

Idle Effects student worksheet.

<https://docs.google.com/document/d/13YhYLOPp3TD26ruFdLAWXEmr4QV4bnMjoG6nWWT0Xlc/edit?usp=sharing>

What's Up with Our Air Google Slide presentation (Breathe Utah)

<https://docs.google.com/presentation/d/1IVdteWvsdfFKESe5kowM8NBGFhCuVa-EfZC4p7nUIBs/edit?usp=sharing>

Idle Observation and Evaluation Form

https://docs.google.com/document/d/1UH_Lt53MPBoFQw1MBvIGQL873fiybYUzmHtILJYIDcc/edit?usp=sharing

Kahoot Quiz: <https://play.kahoot.it/#/k/b52df675-bfa9-4302-b8a1-1694e05cfc51>

Written Quiz:

<https://docs.google.com/document/d/1z2gvtEaAAU2UUaQtiugnrvxk8olKBpbvJ2rouPhcQdE/edit?usp=sharing>

Quiz Answers and Explanations:

<https://docs.google.com/document/d/1-4BGlt4SK3mZZ1-Blsb52KfYHvk-5X6gOdKRY58ISks/edit?usp=sharing>

Analyzing the Data sheet can be used to explain how to analyze the data if needed.

https://docs.google.com/document/d/19x5OgsOn5xhOg1FOYqtk77e_F2fu6N4DrTCQt2da6o/edit?usp=sharing

<http://utahcleancities.org/idlefree-utah> Utah Clean Cities Idle Free

<http://www.ucair.org/> Utah Clean Air

<http://air.utah.gov/> Utah Department of Environmental Quality Air Conditions

<https://www.epa.gov/region8/idle-free-schools> EPA Idle Free Schools

Assessment of Student Learning

1. The Idle Pre/Post Quiz can be used as a pre and post assessment
2. The Idle Effect Quiz can also be used as a pre and post assessment
3. The Five Minute Free Write can be used to assess understanding. The following is a sample response. "The per capita effect of idling is that excess pollution is added to Utah's atmosphere. Every minute that cars idle gas and money are wasted and pollution is added to our air. About about 300 cars come through our school parking lot every morning and afternoon. All together they spend about 1500 minutes idling which wastes about 18 gallons of gas every day, costs about \$40 per day and puts 360 lbs of CO2 into the atmosphere every day. Idling contributes to PM2.5 and ozone pollution as well. PM2.5 gets caught in the lungs. Ozone burns lungs. CO2 contributes to global climate change."

See Student Page for suggested Rubric for Five Minute Free Write

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Extension:	1. Research specific chemistry and health effects of PM2.5 and or ozone 2. Gather data on idling at other places in your city (banks, drive-throughs at restaurants, etc...) 3. Encourage students to give Idle Effects quiz to other family and community members 4. Go to http://air.utah.gov/ to find out the current status of Utah's air quality



Lesson source material courtesy UCCC

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