



Ground-level Ozone: Your Vehicle

Introduction

This exercise examines ground-level ozone, the air pollution commonly referred to as "smog" ("smoke" + "fog" = "smog"). Smog is formed by a combination of air pollutants and sunlight, and can have adverse effects on humans and other organisms. You have likely heard of ozone in a different capacity. Ozone also occurs high above Earth's surface in the stratosphere, where it serves a protective function by blocking harmful ultraviolet radiation from the Sun. The ozone in each case is the same molecule, but in one location (high in the atmosphere) it is beneficial to living things, while at another location (ground-level), it is harmful. The major differences between stratospheric and ground-level ozone is reviewed in the brochure below from the U.S. Environmental Protection Agency

Ozone: Good Up High, Bad Nearby

[Online database of vehicle fuel efficiencies](#)

U.S. Department of Energy

<http://esa21.kennesaw.edu/activities/smog-car/epa-good-up-high.pdf>

Ground-level Ozone: Vehicles

The goal of this exercise is to quantify and analyze your personal contributions of smog-forming compounds due to driving. As detailed in the brochure, vehicles can be a significant contributor of the compounds that cause ground-level ozone. In this exercise, you will estimate the amount of smog-forming compounds from driving and investigate how you might reduce this. To begin your analysis, let's review information on vehicles and ozone with an online brochure from the Federal Highway Administration of the U.S. Department of Transportation on Transportation Air Quality.



Fig. 1: Los Angeles smog (EPA)

[Vehicle Emissions](#) (PDF) (448 KB)

United States Federal Highway Administration (Department of Transportation)

<http://www.fhwa.dot.gov/environment/>

To estimate the amount of ozone-forming compounds generated by your car, we will use data from the Department of Energy's FuelEconomy web site. This site allows you to see how your car rates on air pollution emitted, as well as estimating the tonnage of greenhouse gases emitted driving an average number of miles. As you learned in the Transportation Air Quality brochure, a number of factors influence NO_x and VOC emissions from vehicles. While this data does not take all of these factors into account, it does provide a good estimation of your emissions.

Air Emission Data

FuelEconomy.gov

<http://www.fueleconomy.gov/feg/bymodel/bymakemodelNF.shtml>

Tailpipe Data:

1.	Select your vehicle's make and model, engine from the website. From the list of different engine profiles, choose the appropriate one. Write down your data.
2.	Go back to the initial page. Choose a 2009 Toyota Prius, which is a hybrid vehicle. Write down the data on the activity sheet
3.	Go back to the initial page. This time, choose a 2009 Ford Escape Hybrid FWD. Record the data on the activity sheet.
4.	Lastly, go back to the initial page. This time, select a 2009 Toyota Yaris (automatic). Record the data on the activity sheet.
5.	To find the price for these cars, go to Kelly Blue Book (http://www.kbb.com/). Find the makes and models and enter the information on the activity sheet.

Air Pollution and Asthma

DO NOT COMPLETE THIS SECTION UNTIL YOU'VE COMPLETED THE ACTIVITY ABOVE.

You are undoubtedly aware that many parts of the U.S. have annually reoccurring smog problems. Metropolitan areas like Los Angeles, Houston, Atlanta, and others have often exceed federal air quality standards, posing a health risk to individuals living in the area. While everyone can experience health problems from smog, it is particularly severe for individuals with respiratory ailments such as asthma, as air pollution can act as a "trigger" for respiratory attacks. The American Lung Association states that 24.7 million individuals have been diagnosed with asthma, and about one-third of them are children. Asthma is particularly troubling in children, as it is the number one cause of hospitalization and school absenteeism.

Asthma and Children Fact Sheet

American Lung Association

While most people are generally familiar with asthma, many do not understand the ailment and how it affects lung function. Learn about this by viewing an animated Flash tutorial on asthma from Neomedicus and Merck. If you have a fast Internet connection, choose the version with sound. Use the "no sound" version with slower connections.

What's Asthma All About?

Neomedicus and Merck

Requires [Macromedia Flash](#) player

<http://www.whatsasthma.org/>

Once you've familiarized yourself with this material, complete the Analysis section on "Asthma and Air Pollution" on the Activity sheet.

PHSC 1014

Name:

Tailpipe Tally:

Enter your vehicle's year, make, model, and annual miles driven below.

Year	Make	Model	Annual Miles

Enter your MPG and annual outputs of greenhouse gases for your vehicle in the space below. Enter the information for the other car comparisons (see list below) below that for your car. Use the Kelly Blue Book Value website to find the price of each car.

Vehicle	MPG (City)	MPG (Hwy)	Greenhouse Gas	EPA Score	Price
Your Vehicle					
2009 Toyota Prius					
2009 Ford Escape					
2009 Toyota Yaris					

Analysis:

Vehicle Emissions:

Compare your vehicle to the selected vehicles. How did your vehicle compare? Did this surprise you?

Given the prices of the cars, which one would be the best to buy? Why?

Asthma and Air Pollution:

You've seen that asthma affects large numbers of individuals, attacks can be induced by air pollutants, pollution may act to cause individuals to develop the disease, and asthma attacks are an extremely unpleasant event to endure. You've also likely seen that your current vehicle emits more ozone-forming compounds than a gasoline-electric hybrid vehicle (Toyota Prius) and/or a typical compact car (Ford Focus). So here's the problem - you are, by choice, releasing more harmful pollutants into the atmosphere than if you were to drive these other vehicles for exactly the same distance. These pollutants induce attacks in asthmatics, and may cause children and adults to develop asthma as a result of exposure to your pollution.

Is it morally problematic for you to drive a vehicle that gets lower mileage (and hence releases more pollutants) than another vehicle when you are aware of the adverse impacts of your choice on others?

You should address the question from a variety of viewpoints (ethical, scientific, philosophical, economic, etc). Think about the question carefully before answering, and be sure to explain yourself fully.