Transportation

Last Updated: September 19, 2013

Background

There are many, many forms of transportation. Some methods of transportation include by plane, train, automobile, boat, submarine, motorcycle, bicycle, and foot. All of these have some effect on the environment.

Worldwide, our transportation choices are causing dangerous levels of air pollution. Gasoline powered vehicles burn most of the world's petroleum, introducing pollution such as nitrous oxides and particulates to the surrounding atmosphere to form smog, decrease visibility, and harm human health. Transportation also accounts for more than 12% of greenhouse gas emissions worldwide, and is one of the fastest growing emission sectors. Many countries have emissions regulations controlling transportation pollution for the purposes of improving ambient air quality and human health. While individual emissions have decreased, this has been offset by the increase in number of vehicles and their usage time.

Other environmental impacts of transport systems include traffic congestion, automobile-oriented urban sprawl, and noise and light pollution.

Objectives

Students will be able to:

- Understand that gasoline combustion moves the vehicle as well as emit greenhouse gases.
- Identify a combustion chamber, piston, and exhaust valve in a conventional internal combustion engine vehicle.
- Understand that carbon emissions from vehicles are very large due to the scale of driving that occurs annually.
- Understand that alternative fuel vehicles have lower tailpipe emissions but overall emissions are not necessarily lower.
- Understand that alternative fuel vehicles can emit less carbon than conventional internal combustion engine vehicles but face challenges such as increased cost and lack of fueling infrastructure.
- Understand that buses emit more carbon than individual cars but have a larger passenger capacity.

Materials Needed

- "Transportation presentation.pptx"

Safety Concerns

None.

Vocabulary

- Energy (general): Energy that the plants and animals originally obtained from the sun is stored in the form of carbon in natural gas.
- Internal combustion engine: The internal combustion engine is an engine in which the combustion of a fuel (normally a fossil fuel) occurs with an oxidizer (usually air) in a combustion chamber that is an integral part of the working fluid flow circuit. The expansion of the high-temperature and high-pressure gases produced by combustion apply direct force to some component of the engine. The force is applied typically to pistons, turbine blades, or a nozzle. This force moves the component over a distance, transforming chemical energy into useful mechanical energy.

Procedure

Time	Activity	Description	Supplies
15	Slides	Explain how traditional internal combustion engine vehicles operate.	"Transportation presentation.pptx"
15	Slides	Explain how much people drive every year and the magnitude of transportation emissions.	"Transportation presentation.pptx"
15	Slides	Cars of the future: alternative fuel vehicles including electric vehicles and hydrogen fuel cell cars. Explain goals of saving fuels and reducing emissions.	"Transportation presentation.pptx"
15	Slides	Alternative transportation modes, how can buses be better than cars?	"Transportation presentation.pptx"

Additional Resources

Reputable

US Department of Transportation http://www.dot.gov/

Alternative Fuel Vehicles | US Department of Energy
http://www.fueleconomy.gov/feg/current.shtml

Electric Vehicles | US Department of Energy http://www.fueleconomy.gov/feg/evsbs.shtml

Hybrids | US Department of Energy http://www.fueleconomy.gov/feg/hybrids.jsp

Clean Vehicles | Union of Concerned Scientists http://www.ucsusa.org/clean_vehicles/why-clean-cars/global-warming/

Transportation and Air Quality | US Environmental Protection Agency http://www.epa.gov/otaq/

Opinion / Newspaper

To be added

How an engine works
http://www.youtube.com/watch?v=-8cXXjsRg70

Cost of commuting
http://myfamilysmoney.com/blog/commuting-cost-analysis-bus-vs-bike-vs-car/
http://commutesolutions.org/external/calc.html

Alternative fuel cars
http://www.energyquest.ca.gov/transportation/index.html

How Catalytic Converters Work | How Stuff Works http://auto.howstuffworks.com/catalytic-converter1.htm

Author(s)

Lesson idea from SUCCEED summer program 2013; final product compiled by Kelly Klima on behalf of the Leonard Gelfand Center for Service Learning and Outreach.

Funding Sources

Portions of this work were supported by a) the Leonard Gelfand Center for Service Learning and Outreach, and b) the Center for Climate and Energy Decision Making (SES-0949710) through a cooperative agreement between the National Science Foundation and Carnegie Mellon University.

Next Generation Science Standards Alignment

HS-LS2-7: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

Crosscutting Concept: Stability and Change

HS-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Crosscutting Concept: Stability and Change

HS-ETS1-2: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Crosscutting Concept: Influence of Science, Engineering, and Technology on Society and the Natural World