

# GETTING THERE: TRANSPORTATION LESSONS

**Overview** 1. **Transportation Today** 2. **Where are we?** 3. **Where have we been?** [more...](#)

## Lesson Title

*The Art & Science of "Getting There"*

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## Lesson Overview

This lesson will use a combination of science, PE, and the arts in a multi-step, interdisciplinary approach. First, students will explore the science of transportation technologies, especially fuels and energy usage. Next, students will make connections and comparisons to their own bodies through PE activities regarding human energy through nutrition and physical activity. Finally, using the above knowledge as well as information gained in Lessons 1-3, students have the opportunity to use art, performance, and music to create advertisements for their proposal of a new transportation device.

## Curriculum Subjects

- Science
- PE
- Art (Visual, Performing, and/or Music)

## Estimated Duration

10 hours (including advertisement project)

## Grades

Suitable for grades 5-8

## Curriculum Goals

[National Science Teachers Association standards](http://www.nsta.org/publications/nses.aspx) (<http://www.nsta.org/publications/nses.aspx>):

### Physical Science, Life Science, and Earth and Space Science Standards:

- Properties and changes of properties in matter
- Motions and forces
- Transfer of energy

### Science in Personal and Social Perspectives Standards:

- Personal health
- Populations, resources, and environments
- Natural hazards

- Risks and benefits
- Science and technology in society

[National Association for Sport and Physical Education](http://www.aahperd.org/naspe/standards/nationalStandards/PEstandards.cfm) (<http://www.aahperd.org/naspe/standards/nationalStandards/PEstandards.cfm>):

- Demonstrates understanding of movement concepts, principles, strategies, and tactics as they apply to the learning and performance of physical activities.
- Achieves and maintains a health-enhancing level of physical fitness.

## Objectives

Students will be able to...

- Describe one property of physics involved with a form of transportation
- Define and convert units of energy and bioenergy
- Record speed and ergometric information using exercise technology tools
- Critically analyze advertisements
- Create a persuasive advertisement using appropriate writing, art, and music techniques

## NETS Standards

**1. Creativity and Innovation** Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students:

- a. apply existing knowledge to generate new ideas, products, or processes.
- b. create original works as a means of personal or group expression.

**2. Communication and Collaboration** Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students:

- a. interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media.
- b. communicate information and ideas effectively to multiple audiences using a variety of media and formats.

## Prerequisites

Before engaging in this lesson, students must know or be able to...

- Use a web browser

## Lesson Procedure

### Introductory – Preparatory activities:

What is energy? How is energy used by people? How is energy involved in transportation? Is it possible to make transportation more efficient? How would you convince people to use a new form of transportation?

All of these questions will be explored (and hopefully answered) in this lesson. We will use a combination of science, PE, and art knowledge and skills to synthesize knowledge of past and present transportation technologies and imagine how we could sell people on the idea of using energy-efficient transportation.

Start by exploring the [Vuvox](http://www.vuvox.com/collage/detail/02452ee509) (<http://www.vuvox.com/collage/detail/02452ee509>) to see how PE, energy science, and the arts are related to the rise and change of transportation:



Students will explore science concepts related to transportation technologies using iCue videos and PhET physical simulations. Students should use two simulations or one video and one simulation to prompt their journal responses:

[iCue Environmental Science](http://www.icue.com/portal/site/iCue/chapter/?vgnnextchannel=81491608813df110VgnVCM10000075c1d240RCRD&chapterchannel=98a91608813df110VgnVCM10000075c1d240RCRD): <http://www.icue.com/portal/site/iCue/chapter/?vgnnextchannel=81491608813df110VgnVCM10000075c1d240RCRD&chapterchannel=98a91608813df110VgnVCM10000075c1d240RCRD>

PhET Simulations:

- [The Moving Man](http://phet.colorado.edu/simulations/sims.php?sim=The_Moving_Man) (position, velocity, acceleration): [http://phet.colorado.edu/simulations/sims.php?sim=The\\_Moving\\_Man](http://phet.colorado.edu/simulations/sims.php?sim=The_Moving_Man)
- [Generator](http://phet.colorado.edu/simulations/sims.php?sim=Generator) (magnetic electricity generation): <http://phet.colorado.edu/simulations/sims.php?sim=Generator>
- [Balloons and Buoyancy](http://phet.colorado.edu/simulations/sims.php?sim=Balloons_and_Buoyancy): [http://phet.colorado.edu/simulations/sims.php?sim=Balloons\\_and\\_Buoyancy](http://phet.colorado.edu/simulations/sims.php?sim=Balloons_and_Buoyancy)
- [Lunar Lander](http://phet.colorado.edu/simulations/sims.php?sim=Lunar_Lander) (simulation game): [http://phet.colorado.edu/simulations/sims.php?sim=Lunar\\_Lander](http://phet.colorado.edu/simulations/sims.php?sim=Lunar_Lander)
- [Photoelectric Effect](http://phet.colorado.edu/simulations/sims.php?sim=Photoelectric_Effect) (basis for solar power): [http://phet.colorado.edu/simulations/sims.php?sim=Photoelectric\\_Effect](http://phet.colorado.edu/simulations/sims.php?sim=Photoelectric_Effect)

In their journals, students should answer the following prompts about each video/simulation:

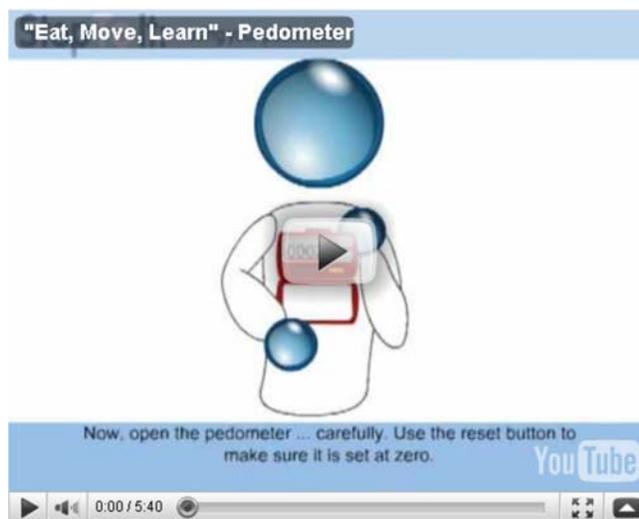
- What did you learn from the video/simulation?
- How is the video/simulation related to transportation?
- What specific modes of transportation are most affected by the concepts in the video/simulation?

### Information presentation and information processing (analysis/synthesis) activities:

Before we determine which methods of transportation would be best and how we can improve the areas of energy, efficiency, and environmental impact, we must first determine how energy is measured and look at human-powered versus fuel-powered transportation. What is similar? What is different? Which are the most *energy-efficient*? Which are the fastest? Which have the least impact on the environment?

To answer these questions -- and keep ourselves healthy in the process! -- we can perform a variety of transport-based exercises, including walking, running, cycling, and rowing. Exercise machines and equipment such as pedometers and heart rate monitors can help us measure how fast we are moving, how hard our hearts are working, and -- with the help of a little math -- how many calories we are burning. View these videos for an introduction to these concepts:

- [Pedometer - Cardioville](http://www.youtube.com/watch?v=dMPpv78supk): <http://www.youtube.com/watch?v=dMPpv78supk>
- [Eat, Move, Learn - Pedometer](http://www.youtube.com/watch?v=td9S_oWzmnc): [http://www.youtube.com/watch?v=td9S\\_oWzmnc](http://www.youtube.com/watch?v=td9S_oWzmnc)



In their journals, students should make predictions about which types of transportation will be fastest, which will require the most energy, and which will be the most sustainable (able to keep moving without stopping), all based on energy measurements (calories/joules).

Then try the fun [Eating & Exercise simulation at PhET](http://phet.colorado.edu/simulations/sims.php?sim=Eating_and_Exercise) ([http://phet.colorado.edu/simulations/sims.php?sim=Eating\\_and\\_Exercise](http://phet.colorado.edu/simulations/sims.php?sim=Eating_and_Exercise)) to see how food intake and exercise affect your body and your energy!

### Application activities:

#### Activity 1: Energy and Motion

1) Students engage in a variety of physical activities including walking, running, and cycling, recording health data as they do. Students enter this data into a shared Google doc. At the end of the week, the aggregate data is used to show average values for each measurement of each activity (as a whole group activity, find the mean of the class data sets for each type of human-powered transportation)

2) Introduce the scientific definition of calorie and measurements of energy/heat:

[How Stuff Works - "How Calories Work"](http://health.howstuffworks.com/calorie1.htm): <http://health.howstuffworks.com/calorie1.htm>

Students use statistics for average calories used in various activities and the equivalent energy used in an automobile over the same amount of time:

[Bioenergy Conversion Factors](http://bioenergy.ornl.gov/papers/misc/energy_conv.html): [http://bioenergy.ornl.gov/papers/misc/energy\\_conv.html](http://bioenergy.ornl.gov/papers/misc/energy_conv.html)

[Energy Expenditure for Exercises](http://www.brianmac.co.uk/energyexp.htm): <http://www.brianmac.co.uk/energyexp.htm>

Using these conversion rates and the rates discovered during your exercises (such as miles per hour, calories per hour, or calories per mile), compare the human-powered transportation to a gas-powered automobile.

Which one is more efficient? Which will last longer? Why?

Finally, go to [Smart-Mouth.org](http://www.cspinet.org/smartmouth/index1.html) (<http://www.cspinet.org/smartmouth/index1.html>) and play the Choose Your Chews game to see how many calories you consume in a day! Just pick from a selection of foods to show what you eat in an average day, and it will calculate calories (and saturated fat) for you:

[Choose Your Chews](http://www.cspinet.org/cgi-bin/smartmouth/choose.pl): <http://www.cspinet.org/cgi-bin/smartmouth/choose.pl>

#### Activity 2: Advertising Transportation

In this activity, students will use what you learned about the physics and mechanics of transportation and the use of energy in Activity 1, and will combine it with art, music, and persuasive writing skills to create an advertisement for a new type of transportation.

1) Students will learn some of the terms and techniques related to advertisements, starting with print ads and continuing to radio and TV advertising. Students will critically analyze these products to determine what is being sold, to whom they are trying to sell it, and what persuasive techniques are being used. To do this, go to History Matters "Making Sense of Ads" and read through the "Getting Started" and "Questions to Ask" pages to learn how to critically view and analyze advertisements, then click on the ["Try it Yourself"](#) link:

[History Matters - Making Sense of Ads](http://historymatters.gmu.edu/mse/ads/intro.html): <http://historymatters.gmu.edu/mse/ads/intro.html>

2) Students will plan their projects, starting with a concept of a "better" vehicle. After designing a vehicle (using information gained from all previous activities), students will next plan/design their advertisements. The advertisements could be a video commercial, animation, or print ad and radio jingle. The final product should include a script (for live, animation, or video production) or lyrics as well as drawings (ad sketches or storyboards.) View the following example of a very old car advertisement (made by the same animation studio that made "Popeye"):



3) Students produce the written, visual, and audio components of their advertisements. Use the following resources to guide creation of

print ads and musical jingles:

- [How to Create a Print Advertisement](http://www.ehow.com/how_2170696_print-advertisement.html): [http://www.ehow.com/how\\_2170696\\_print-advertisement.html](http://www.ehow.com/how_2170696_print-advertisement.html)
- [Jingle Demos](http://www.jinglekings.com/Jingle_Demos.html): [http://www.jinglekings.com/Jingle\\_Demos.html](http://www.jinglekings.com/Jingle_Demos.html)
- [How to Write a Jingle](http://www.howtodothings.com/hobbies/a4312-how-to-write-a-jingle.html): <http://www.howtodothings.com/hobbies/a4312-how-to-write-a-jingle.html>

4) Students share their advertisements online in a special page of the class Wiki.

### Closure/review activities:

Students will go to the class Wiki to review their peers' advertisement commercials, jingles, and print ads. Each student will assess the effectiveness of two other teams' finished products by using the same rubric the teacher will use for grading.

### Assessment / Evaluation

- Student Journal Responses: (4) Student has correctly answered all questions and has provided reasons why they interpreted or believed some of the conclusions the way they did. (3) Student has correctly answered all questions but has not provided reasons why they interpreted or believed some of the conclusions. (2) The student has answered at least half, but not all, of the questions correctly. (1) Student has answered half or fewer of the inquiry/reflection questions in the lesson.
- Energy Efficiency and Conversion Quiz
- Advertisement Project Rubric

### Accommodations / Differentiation

- **Cognitive Difficulties:** Using a combination of step-by-step instructions, videos, and interactive simulations should prove useful for engaging and appealing to a variety of ability levels and "intelligences" or cognitive learning styles.
- **Physical Difficulties:** As usual, alternative mouse/pointer input devices may be used. Some physical impairments may prevent certain students from engaging in particular PE exercises (such as the pedometer measurements) -- a wonderful and interesting modification would be to have students use and determine data (speed, energy consumption) for *wheelchairs* and add this to the list of human-powered transportation.
- **Sensory Difficulties:** This lesson is a good example of *universal design*: allowing students to practice persuasive writing tactics through a variety of creative products allows students who may be visually- or hearing-impaired to focus on a type of product they are capable of completing. At the same time, working in teams allows each student member of the team to work on a piece that they are competent with.
- **At-Risk Students:** The benefits of student-elected, team-based art/music products also benefits at-risk students. Student choice raises the motivation and buy-in for completing the product, and being able to work in teams boosts self-confidence and assistance for students who might otherwise not complete an entire project or feel proficient in all aspects of the production.
- **GATE Students:** The universal design considerations of this lesson also benefit GATE students, who benefit from "sky's the limit" creative projects made possible through the use of these creative technologies, and can be challenged in one of the following ways: (a) offered the opportunity to complete the creative advertisement individually instead of in a group; (b) work as a partner/mentor with at-risk or cognitively-challenged students.

### Materials, Resources, and Equipment

Required hardware/software:

- Computers with Internet connection (at least one for every 2 students)
- PE measuring devices/technologies: pedometers, exercise bikes (optional), ergometers (optional)
- Audio recording/editing/production software and music instruments (real or "virtual")
- Varied art/multimedia tools and supplies (could include traditional materials and a scanner, or any combination of the following: vector graphic software; animation software; photo editing/manipulation; video editor)

Videos:

- [In My Merry Oldsmobile](http://www.youtube.com/watch?v=nU4ZNkLk4Ys): <http://www.youtube.com/watch?v=nU4ZNkLk4Ys>
- [Pedometer - Cardioville](http://www.youtube.com/watch?v=dMPpv78supk): <http://www.youtube.com/watch?v=dMPpv78supk>
- [Eat, Move, Learn - Pedometer](http://www.youtube.com/watch?v=td9S_oWzmnc): [http://www.youtube.com/watch?v=td9S\\_oWzmnc](http://www.youtube.com/watch?v=td9S_oWzmnc)

Science simulations:

- [The Moving Man](http://phet.colorado.edu/simulations/sims.php?sim=The_Moving_Man) (position, velocity, acceleration): [http://phet.colorado.edu/simulations/sims.php?sim=The\\_Moving\\_Man](http://phet.colorado.edu/simulations/sims.php?sim=The_Moving_Man)
- [Generator](http://phet.colorado.edu/simulations/sims.php?sim=Generator) (magnetic electricity generation): <http://phet.colorado.edu/simulations/sims.php?sim=Generator>
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- [Lunar Lander](http://phet.colorado.edu/simulations/sims.php?sim=Lunar_Lander) (simulation game): [http://phet.colorado.edu/simulations/sims.php?sim=Lunar\\_Lander](http://phet.colorado.edu/simulations/sims.php?sim=Lunar_Lander)
- [Photoelectric Effect](http://phet.colorado.edu/simulations/sims.php?sim=Photoelectric_Effect) (basis for solar power): [http://phet.colorado.edu/simulations/sims.php?sim=Photoelectric\\_Effect](http://phet.colorado.edu/simulations/sims.php?sim=Photoelectric_Effect)

- [Eating & Exercise simulation](http://phet.colorado.edu/simulations/sims.php?sim=Eating_and_Exercise): [http://phet.colorado.edu/simulations/sims.php?sim=Eating\\_and\\_Exercise](http://phet.colorado.edu/simulations/sims.php?sim=Eating_and_Exercise)

Website resources:

- [Vuvox](http://www.vuvox.com/collage/detail/02452ee509): <http://www.vuvox.com/collage/detail/02452ee509>
- [iCue Environmental Science](http://www.icue.com/portal/site/iCue/chapter/?vgnnextchannel=81491608813df110VgnVCM10000075c1d240RCRD&chapterchannel=98a91608813df110VgnVCM10000075c1d240RCRD): <http://www.icue.com/portal/site/iCue/chapter/?vgnnextchannel=81491608813df110VgnVCM10000075c1d240RCRD&chapterchannel=98a91608813df110VgnVCM10000075c1d240RCRD>
- [How Stuff Works - "How Calories Work"](http://health.howstuffworks.com/calorie1.htm): <http://health.howstuffworks.com/calorie1.htm>
- [Bioenergy Conversion Factors](http://bioenergy.ornl.gov/papers/misc/energy_conv.html): [http://bioenergy.ornl.gov/papers/misc/energy\\_conv.html](http://bioenergy.ornl.gov/papers/misc/energy_conv.html)
- [Energy Expenditure for Exercises](http://www.brianmac.co.uk/energyexp.htm): <http://www.brianmac.co.uk/energyexp.htm>
- [Smart-Mouth.org](http://www.cspinet.org/smartmouth/index1.html): <http://www.cspinet.org/smartmouth/index1.html>
- [History Matters - Making Sense of Ads](http://historymatters.gmu.edu/mse/ads/intro.html): <http://historymatters.gmu.edu/mse/ads/intro.html>
- [How to Create a Print Advertisement](http://www.ehow.com/how_2170696_print-advertisement.html): [http://www.ehow.com/how\\_2170696\\_print-advertisement.html](http://www.ehow.com/how_2170696_print-advertisement.html)
- [Jingle Demos](http://www.jinglekings.com/Jingle_Demos.html): [http://www.jinglekings.com/Jingle\\_Demos.html](http://www.jinglekings.com/Jingle_Demos.html)
- [How to Write a Jingle](http://www.howtodothings.com/hobbies/a4312-how-to-write-a-jingle.html): <http://www.howtodothings.com/hobbies/a4312-how-to-write-a-jingle.html>

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