

# ENVIRONMENTAL EDUCATION PROGRAMS



Lesson Offerings: 2017-2018





**HART's free Environmental Education Program explores the connection between transportation choice and impact on the environment.**

**This elementary school program is designed to educate students in grades K-8 on issues of sustainable transportation options in their community.**

**All lessons meet NJ Core Curriculum standards.**

**We invite you to browse through our offerings on the pages that follow.**

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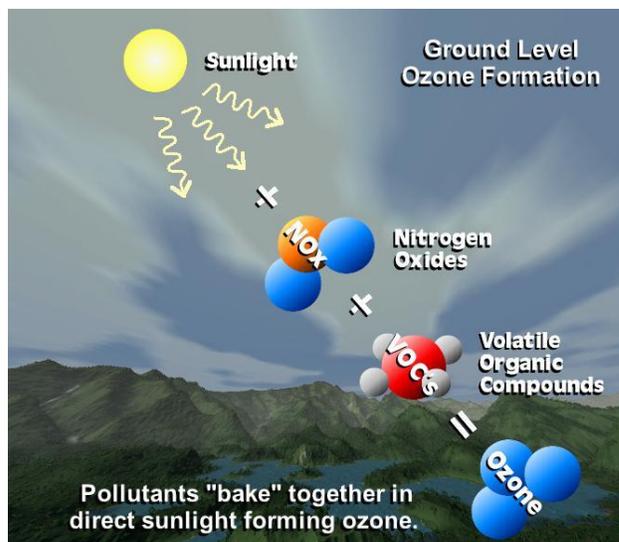
# Air Quality

Air quality impacts our lives on a daily basis. When you breathe air into your lungs you are not only breathing the oxygen required to live, but also a combination of other compounds, some of which can cause serious health and environmental problems. Greenhouse gases contribute to climate change.

“Greenhouse gas” is a gas in an atmosphere that absorbs and emits radiation within the thermal infrared range.

The primary greenhouse gases in Earth's atmosphere are water vapor, carbon dioxide, methane, nitrous oxide, and ozone. Ground-level ozone is one of our nation's most common air pollutants. Ground Level Ozone occurs in the Earth's lower atmosphere, near ground level, when pollutants emitted by cars and other air pollution sources react chemically in the presence of sunlight.

The Air Quality lessons on the pages that follow are all designed to provide students with age appropriate information, an interactive activity and a “call to action” related to understanding and improving air quality.



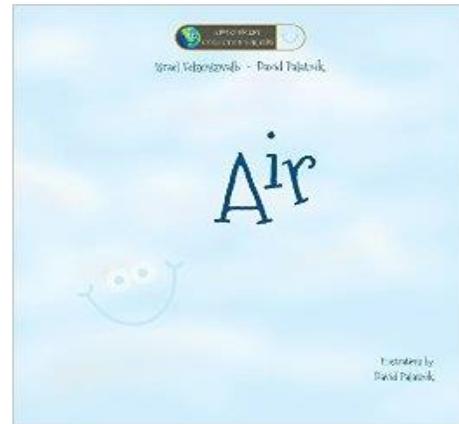
## Reading Series – “Air”

Grade(s): 1-3

### Learning Objectives

Students will be able to:

- Describe what AIR is and why it is important
- Provide common air pollutants



### Overview

Students are read this short book which describes what air is, the importance of clean air, and actions that can be taken in our daily lives to improve air quality.

Following the reading of the book, students will participate in a “Clean Air Bingo” game. Students will be asked questions that pertain to the book and must find the answer on a bingo card.

Students will also be provided with clean air activity packets to take home that will help to reinforce the message of keeping our air clean.

This lesson is also a great precursor to the “[What's Air Got To Do With It](#)” and “[Air Quality Experiment](#)” Lessons. This lesson can be designed to incorporate these other activities.

### Curriculum Standards

#### **Literacy**

- CCSS.ELA-Literacy.CCRA.R.[2&3]
- CCSS.ELA-Literacy.CCRA.R.8
- CCSS.ELA-Literacy.CCRA.RL.1.1
- CCSS.ELA-Literacy.CCRA.RL.1.3
- CCSS.ELA-Literacy.CCRA.RL.1.7
- CCSS.ELA-Literacy.CCRA.RL.2.[1 & 3]
- CCSS.ELA-Literacy.CCRA.RL.3.3
- CCSS.ELA-Literacy.CCRA.RL.4.[2 & 4]

#### **Science**

- CCSS.ELA-Literacy.CCRA.SL.1.[1 & 2]
- CCSS.ELA-Literacy.CCRA.SL.2.[1 & 2]
- CCSS.ELA-Literacy.CCRA.SL.3.1

- 5.1.4.A.1
- 5.1.4.D.1
- 5.2.2.C.1
- 5.2.4.C.1

#### **Social Studies**

- 6.3.4.A.3
- 6.3.4.B.1

#### **Health/PE**

- 2.1.2.C.2
- 2.1.2.D.[1 & 3]
- 2.1.4.C.[1 & 2]
- 2.1.4.D.[1 & 3]
- 2.2.2.B.2
- 2.2.4.A.1
- 2.2.4.B.[1 & 2]
- 2.5.2.C.[1 & 2]

#### **Life & Career Skills**

- 9.1.4.A.1
- 9.1.4.B.1
- 9.1.4.C.1
- 9.1.4.D.1
- 9.1.4.F.3

## Reading Series - “Owls for the Environment”

Grade(s): 1-4

### Learning Objectives

Students will be able to:

- Understand how transportation and energy choices can impact not only the environment but personal health as well.

### Overview

This lesson utilizes a three part book series that focuses on the impact that transportation choice and energy use have on the environment as well as strategies to improve air quality.



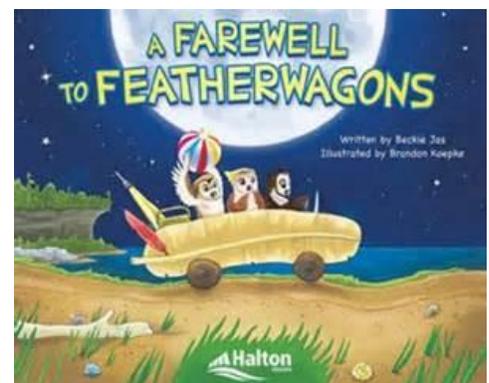
The lesson begins with the reading of the book to the students.

Following the story, students participate in a game designed to reinforce the key concepts introduced in the books. Working in teams, students will answer questions from the book and earn points.

### **A Farewell to Featherwagons**

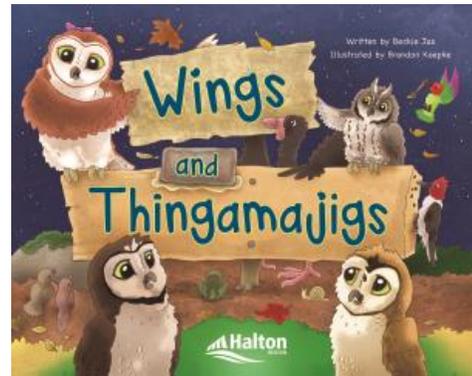
In this first book of the series, students are introduced to owls Biff, Tyto, and Alba Alba. The fictional owls take a trip to the great lake to go swimming. But, along the way they find that their current mode of transportation, the “featherwagon”, is having an impact on the environment and their health.

Eventually the owls realize that it would be better to use their wings than their vehicle to get places that they want to go.



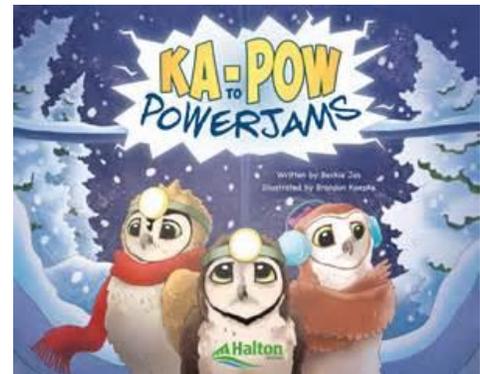
## Wings and Thing-a-majigs

In this book, the owls go to school! When the owls arrive on the first day, all of the featherwagons are idling in front of the school. Teacher, Mrs. Hootz, gives her students an assignment to design and build a "thing-a-majig" as an alternative to the polluting feather wagons. The owls learn how much fun it can be getting to school without their featherwagons.



## Ka-Pow to Powerjams

In this story, the owls learn about energy conservation as well as emergency preparedness. When the owls have to survive a blackout they learn about how they can have an impact on the environment by conserving energy.



### Curriculum Standards

#### Literacy

- CCSS.ELA-Literacy.CCRA.R.[2&3]
- CCSS.ELA-Literacy.CCRA.R.8
- CCSS.ELA-Literacy.CCRA.RL.1.1
- CCSS.ELA-Literacy.CCRA.RL.1.3
- CCSS.ELA-Literacy.CCRA.RL.1.7
- CCSS.ELA-Literacy.CCRA.RL.2.[1 & 3]
- CCSS.ELA-Literacy.CCRA.RL.3.3
- CCSS.ELA-Literacy.CCRA.RL.4.[2 & 4]

- CCSS.ELA-Literacy.CCRA.SL.1.[1 & 2]
- CCSS.ELA-Literacy.CCRA.SL.2.[1 & 2]
- CCSS.ELA-Literacy.CCRA.SL.3.1

#### Science

- 5.1.4.A.1
- 5.1.4.D.1
- 5.2.2.C.1
- 5.2.4.C.1

#### Social Studies

- 6.3.4.A.3
- 6.3.4.B.1

#### Health/PE

- 2.1.2.C.2
- 2.1.2.D.[1 & 3]
- 2.1.4.C.[1 & 2]
- 2.1.4.D.[1 & 3]
- 2.2.2.B.2
- 2.2.4.A.1
- 2.2.4.B.[1 & 2]
- 2.5.2.C.[1 & 2]

#### Life & Career Skills

- 9.1.4.A.1
- 9.1.4.B.1
- 9.1.4.C.1
- 9.1.4.D.1
- 9.1.4.F.3

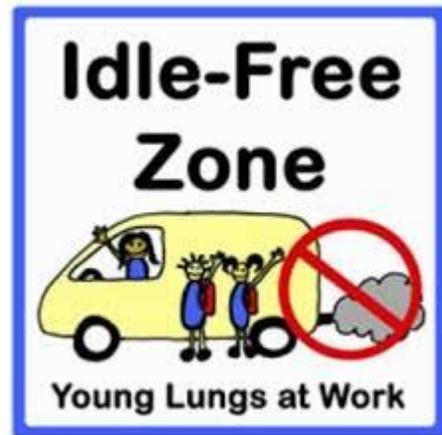
## Reading Series – New Anti-Idling Book

Grade(s): 1-3

### Learning Objectives

Students will be able to:

- Describe idling and how it impacts our health and the environment
- Identify strategies to change idling behavior at school



### Overview

In this story written by HART staff a young boy journeys around the globe to see how air pollution negatively impacts different regions of our planet.

Students gain an understanding of how idling a vehicle can impact health and the environment and what strategies can be employed to reduce the number of vehicles idling outside of school (walking to school, awareness campaign idling laws, etc)

This book is an excellent introduction to an [Anti-Idling campaign](#).

### Curriculum Standards

#### **Literacy**

- CCSS.ELA-Literacy.CCRA.R.[2&3]
- CCSS.ELA-Literacy.CCRA.R.8
- CCSS.ELA-Literacy.CCRA.RL.1.1
- CCSS.ELA-Literacy.CCRA.RL.1.3
- CCSS.ELA-Literacy.CCRA.RL.1.7
- CCSS.ELA-Literacy.CCRA.RL.2.[1 & 3]
- CCSS.ELA-Literacy.CCRA.RL.3.3
- CCSS.ELA-Literacy.CCRA.RL.4.[2 & 4]

- CCSS.ELA-Literacy.CCRA.SL.1.[1 & 2]
- CCSS.ELA-Literacy.CCRA.SL.2.[1 & 2]
- CCSS.ELA-Literacy.CCRA.SL.3.1

#### **Science**

- 5.1.4.A.1
- 5.1.4.D.1
- 5.2.2.C.1
- 5.2.4.C.1

#### **Social Studies**

- 6.3.4.A.3
- 6.3.4.B.1

#### **Health/PE**

- 2.1.2.C.2
- 2.1.2.D.[1 & 3]
- 2.1.4.C.[1 & 2]
- 2.1.4.D.[1 & 3]
- 2.2.2.B.2
- 2.2.4.A.1
- 2.2.4.B.[1 & 2]
- 2.5.2.C.[1 & 2]

#### **Life & Career Skills**

- 9.1.4.A.1
- 9.1.4.B.1
- 9.1.4.C.1
- 9.1.4.D.1
- 9.1.4.F.3

## What's Air Got To Do With It?

Grade(s): 2-4

### Learning Objectives

Students will be able to:

- Identify some main causes, effects, and sources of air pollution
- Understand and explain the different properties of air

### Overview

What is air? Why is it important? Students will participate in a series of activities and demonstrations that will be used to teach them about some of the scientific properties of air.

#### Demonstration #1 – Air Takes up Space

For the most part we cannot see the air, so how do we know that it is even there? This two part demonstration will show students that air is not only all around us but is interacting with every surface that it touches.

#### Demonstration #2 – Air has Mass

How can we tell that air has mass? It doesn't feel like it does. Through this demonstration the students will see how we can tell that air does indeed have mass.

#### Demonstration #3 – Air exerts Pressure

How do we know that air is interacting with objects that it surrounds? Through this set of demonstrations the students can see firsthand that air is exerting pressure on the objects that it touches.

### Curriculum Standards

#### **Science**

- 5.1.4.B.1
- 5.1.4.D.1
- 5.4.4.E.1
- 5.4.6.F.1

#### **Physical Education, Health & Safety**

- 2.1.4.A.1
- 2.1.4.C.[1-2]
- 2.1.4.D.[1 & 3]
- 2.1.6.C.2
- 2.1.6.D.3
- 2.2.4.B.[2 & 3]
- 2.2.6.B.1
- 2.2.6.D.2
- 2.2.6.E.2



## Air Quality Experiment

Grade(s): 4-6

### Learning Objectives

Students will be able to:

- Define air pollution
- Describe what makes up air pollution
- Explain the scientific method

### Overview

How clean is the air you are breathing right now? How about the air at home? That is what students will find out in this lesson!

Students will create air quality testers that they can hang at home or at school. The air testers are hung and monitored for a week. Students will look for air pollution residue on the cards. Students will chart and graph their findings.

The overall theme of this lesson is to utilize the scientific method to perform an experiment that will show the students what exactly is in the air.

### Curriculum Standards

#### **Science**

- 5.1.4.B.1
- 5.1.4.D.1
- 5.4.4.E.1
- 5.4.6.F.1

#### **Physical Education, Health & Safety**

- 2.1.4.A.1
- 2.1.4.C.[1-2]
- 2.1.4.D.[1 & 3]
- 2.1.6.C.2
- 2.1.6.D.3
- 2.2.4.B.[2 & 3]
- 2.2.6.B.1
- 2.2.6.D.2
- 2.2.6.E.2



## The Greenhouse Effect

Grade(s): 4-6

### Learning Objectives

Students will be able to:

- Explain how a greenhouse works
- Explain what the greenhouse effect is and how it impacts our planet
- Name a few greenhouse gases and what we can do to limit their impact on our planet



### Overview

How do greenhouse gases impact our climate? Students will create their own ecosystem by putting dirt, water and decorations into 2 jars. One jar will be covered. The other jar will be left uncovered. Using thermometers attached to the inside of the jar, participants will monitor the ecosystems for 10 minutes; recording the temperature inside each jar at 1 minute intervals.

Participants will learn about how a greenhouse works to trap heat and, by extension, will learn about how greenhouse gases work within our atmosphere to make the planet warmer.

Students will then brainstorm ideas on how to decrease the greenhouse effect inside their bottles as well as how we can decrease greenhouse gases in our environment.

### Curriculum Standards

#### **Social Studies**

- 6.1.4.A.15
- 6.1.4.B.5
- 6.1.4.B.9
- 6.1.4.C.12
- 6.1.4.C.15
- 6.1.4.C.16

#### **Science**

- 5.1.4.D.1
- 5.1.4.D.2
- 5.2.4.C.1
- 5.2.4.E.3

#### **Life & Career Skills**

- 9.1.4.A.[2 - 5]
- 9.1.4.C.1
- 9.1.4.D.1

#### **Technology**

- 8.2.4.A.1
- 8.2.4.B.2
- 8.2.4.B.3
- 8.2.4.G.3

# Carbon Footprint

Grade(s): ALL

[\\*Sustainable Jersey for Schools](#)

## Action

### Learning Objectives

Students will be able to:

- Explain what a Carbon Footprint is and why it is important
- Understand how to identify/measure their own carbon footprint
- Start the process of estimating the school's carbon footprint



### Overview

What is a Carbon Footprint? Why is it important to understand your impact on our planet? Students will learn what activities contribute to their Carbon Footprint by participating in an interactive game. Following their calculation of their individual Carbon Footprint, students will calculate the Carbon Footprint for the class as a whole.

As an offshoot of this lesson the students can help conduct a school wide Carbon Footprint assessment to see where improvements could be made to make the school more sustainable. Data collected can be used to not only see the footprint the school has but also to help make small changes that can lead to big strides in helping to protect our planet. This data can also be used to see where the school can make changes to potentially save money and have an immediate impact on their students and staff.

### Curriculum Standards

#### **Social Studies**

- 6.1.4.A.15
- 6.1.4.B.5
- 6.1.4.B.9
- 6.1.4.C.12
- 6.1.4.C.15
- 6.1.4.C.16

#### **Science**

- 5.1.4.D.1
- 5.1.4.D.2
- 5.2.4.C.1
- 5.2.4.E.3

#### **Life & Career Skills**

- 9.1.4.A.[2 - 5]
- 9.1.4.C.1
- 9.1.4.D.1

#### **Technology**

- 8.2.4.A.1
- 8.2.4.B.2
- 8.2.4.B.3
- 8.2.4.G.3

# Outdoor Air Quality Awareness Program

Grade(s): ALL

[\\*Sustainable Jersey for Schools Action](#)

## Learning Objectives

Students will be able to:

- Explain the different levels of Air Quality and what they mean

## Overview

An Outdoor Air Quality Awareness Program is an essential program to help protect vulnerable populations within a school community. This could include young children, those with asthma or other breathing problems, and adults who shouldn't be exposed to poor air quality.

Students will learn all about the Air Quality "Flag Program" which indicates the air pollution levels around the school to let students, faculty and parents know what to expect in the way of air quality for the day. This lesson can also be a stepping stone in implementing a flag program at your school. HART staff will assist you in the implementation and set-up of the program, assist with the information outreach to students, staff, and parents.

Setting up a program to inform vulnerable populations within your school community will also make your school eligible for points in the Sustainable Jersey for Schools Program. For more information about this program please feel free to follow the link at the top of this page.

## Curriculum Standards

### Life & Career Skills

#### Elementary

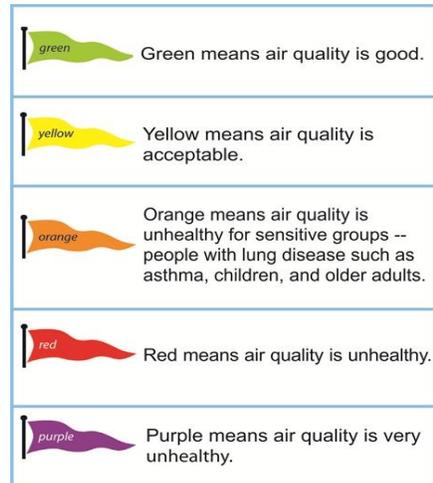
- 9.1.4.A.1
- 9.1.4.A.5
- 9.1.4.B.1

#### Middle School

- 6.3.8.C.1
- 9.1.8.A.2
- 9.1.8.A.4
- 9.1.8.C.3
- 9.1.8.D.3

#### High School

- 9.1.12.B.1
- 9.1.12.B.3
- 9.1.12.C.1
- 9.1.12.C.[4&5]



## Clean Air Week Challenge

Grade(s): ALL

\*[Sustainable Jersey for Schools Action](#)

### Learning Objectives

Students will be able to:

- Describe the importance of keeping the air clean at school
- Define and use alternative forms of transportation such as carpooling, walking, bicycling



### Overview

Developed by faculty at Holland Township School, a "Clean Air Week Challenge" is a way to improve air quality around the school, raise awareness of the harmful impacts of idling and "single occupancy vehicle" use (excess CO<sub>2</sub> emissions). Clean Air Week challenges students, parents and faculty to reduce this impact by pledging to carpool, walk, ride the bus to school, and reduce idling every day for a week.

The challenge is designed for the entire school to participate, but could be geared towards a single classroom, grade level or portion of the school population. The idea is to create a friendly competition among the students or classrooms to see who is the "Clean Air Week Champion". Some example activities that could be performed as part of the competition are:

- Clean Air Superheroes
- Bus Driver Appreciation
- Safety Presentations
- Anti-Idling Campaign
- Public Service Announcements
- Alternative Transportation Pledges

The challenge portion of the program can be performed alone or in coordination with other educational programs to teach the students about the need for clean air around their school.

### Curriculum Standards

#### Life & Career Skills

##### Elementary

- 9.1.4.A.1
- 9.1.4.A.5
- 9.1.4.B.1

##### Middle School

- 6.3.8.C.1
- 9.1.8.A.2
- 9.1.8.A.4
- 9.1.8.C.3
- 9.1.8.D.3

##### High School

- 9.1.12.B.1
- 9.1.12.B.3
- 9.1.12.C.1
- 9.1.12.C.[4&5]

\*Note: Extra lessons and presentations performed during this event will impact the Curriculum Standards

## Anti-Idling Campaign

Grade(s): 5-12

[\\*Sustainable Jersey for Schools action](#)

### Learning Objectives

Students will be able to:

- Define vehicle idling
- Explain how vehicle idling can impact them and their community
- Develop strategies to improve air quality at the school



### Overview

We have all seen it. Cars sitting in one spot while turned on for an extended period of time. Vehicle idling happens everywhere, whether you are at the school, at home, at the store, or pretty much anywhere else. Idling our vehicles is not only hazardous to our health and can increase air pollutants, but is also against the law and in most cases does not help our vehicles, as is the common misconception.

In this lesson, students participate in a “Jeopardy” style game to learn about idling, its impacts, and alternatives.



### Curriculum Standards

#### Life & Career Skills

##### Elementary

- 9.1.4.A.1
- 9.1.4.A.5
- 9.1.4.B.1

##### Middle School

- 6.3.8.C.1
- 9.1.8.A.2
- 9.1.8.A.4
- 9.1.8.C.1
- 9.1.8.C.3

##### High School

- 9.1.12.A.1
- 9.1.12.C.4
- 9.1.12.C.5

### Complementary Activities

- Idling Audit: Students conduct a week long observation and data collection of the number of vehicles idling beyond NJ's 3 minute idling law outside of their school.
- “Design-a-sign” program: Students design a signs to convey an anti-idling message. Students vote on a final sign(s) to be produced by HART and that can be installed outside of the school to discourage idling.

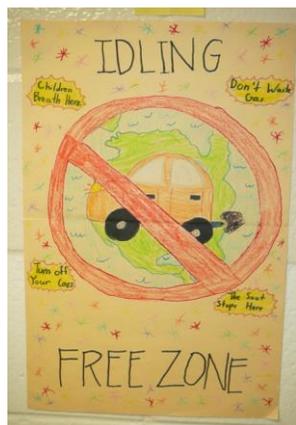
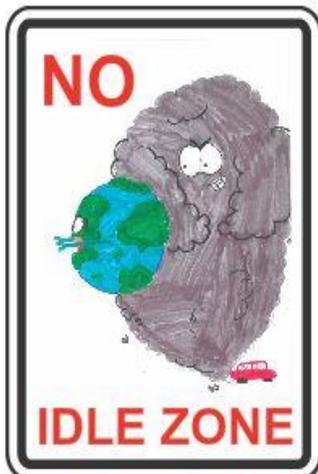
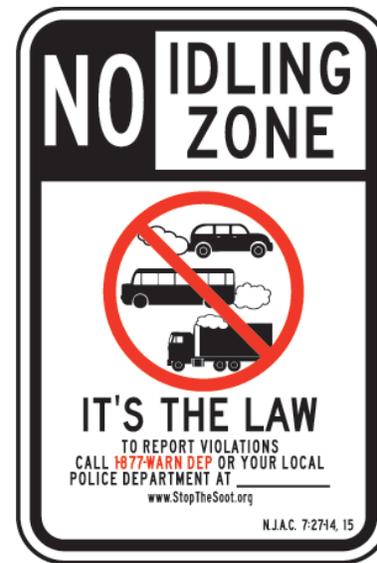
- Clean Air Week is a school based challenge that has students (and parents) commit to making the air cleaner at their school for one week.

## Anti-Idling Design-a-Sign

### Overview

Students are engaged to design a custom sign, to communicate new Jersey's "No Idle" law. The custom sign will be produced by HART, free of charge, for installation at your school.

\*Schools may request an official New Jersey anti-idling sign (shown at right), at no cost, as well.



### **Successful IDLING Programs: Milford Public School & High Bridge Elementary**

Following an introduction to vehicle idling through HART's Environmental Education Program Students at both of these schools decided that it would be great to change the behavior at their individual schools. With the assistance of their teachers and HART staff these students were able to conduct their own anti-idling programs.

#### **Milford Public School**

- 8<sup>th</sup> grade students conducted two weeks of initial data collection to see how bad the idling problem was at their school and found that, of those parents who idled their vehicles 50% of them idled for between 6-10 minutes.
- Following this information students decided that they needed to hang signs at the school to encourage better behavior. Five (5) entries into the contest were created and the students voted on the current sign (top left) that now hangs at the school pick-up/drop-off zone.

#### **High Bridge Elementary School**

- Students in the 4<sup>th</sup> grade, after school, environmental club decided that idling was an issue at their school, but they wanted to find out just how bad the issue was. During January 2015 students conducted an idling inventory at the pick-up zone of the school and found that during the five (5) days tested there was almost 17 hours of vehicle idling. That's over 3 hours of idle time every day during a 15 minute time period studied.
- Students then conducted a design contest and set up a voting booth so that the school could choose which design they would like at their school. In the fall of the 2015-16 school year this sign (bottom left) will be installed at the school to encourage parents not to idle their vehicles while waiting for their students.
- Following sign installation and an informational campaign about idling students will conduct a second idling inventory to see how their efforts have changed behaviors at their school.

## Sustainability Workshop

Grade(s): TEACHERS & STAFF

\*Sustainable Jersey for Schools

Action(s)

[K](#), [1](#), [2](#), [3](#), [Art](#), [Career](#), [ELA](#), [Health](#),  
[Math](#), [Science](#), [Social Studies](#),  
[Technology](#)

Time: 90 minutes

### Learning Objectives

Following the workshop you will be able to:

- Explain what sustainability is and what it means for your school and community
- Begin incorporating elements of sustainability into your school curriculum

### Overview

What is Sustainability? How does it impact me, my family, my classroom, my school, or my community? What part do I play?

Through participation in this workshop you and your colleagues will gain a better understanding about sustainability and how it can be incorporated into your classrooms. We will begin by playing a series of card games which simulates a fishery. Throughout the game you will be asked to perform differently and report how the fish population differs from one scenario to another. The goal of this exercise is to teach you about systems that don't work to get you to start thinking about more sustainable solutions.

Following this game we will discuss the different types of mental models were present in the room during the game. After discussing these models we will then discuss mental models for a sustainable future and how these can be incorporated into classrooms.



## Alternative Fuels

Over the past several decades, there have been enormous strides in the development and implementation of alternative fuel sources to power motor vehicles.

These fuels include electric, biodiesel, hydrogen, compressed natural gas and propane.

Through the following lessons, students will be introduced to these alternative energy sources, specifically as they pertain to transportation.



## Reading Series – “Daniel & His Electric Car”

Grade(s): 1-3

### Learning Objectives

Students will be able to:

- Describe an electric vehicle and how it works
- Provide examples of when someone might want to purchase an electric vehicle and why

### Overview

Daniel and his family are trying to decide which type of vehicle to buy. Through this lesson, students will learn about electric vehicles as an alternative to traditional fossil fuel powered engines. Discussion will also include information on hybrid technology.

Following the reading of the book, students will participate in a coloring activity.

### Curriculum Standards

#### Literacy

- CCSS.ELA-Literacy.CCRA.R.[2&3]
- CCSS.ELA-Literacy.CCRA.R.8
- CCSS.ELA-Literacy.CCRA.RL.1.1
- CCSS.ELA-Literacy.CCRA.RL.1.3
- CCSS.ELA-Literacy.CCRA.RL.1.7
- CCSS.ELA-Literacy.CCRA.RL.2.[1 & 3]
- CCSS.ELA-Literacy.CCRA.RL.3.3
- CCSS.ELA-Literacy.CCRA.RL.4.[2 & 4]

- CCSS.ELA-Literacy.CCRA.SL.1.[1 & 2]
- CCSS.ELA-Literacy.CCRA.SL.2.[1 & 2]
- CCSS.ELA-Literacy.CCRA.SL.3.1

#### Science

- 5.1.4.A.1
- 5.1.4.D.1
- 5.2.2.C.1
- 5.2.4.C.1

#### Social Studies

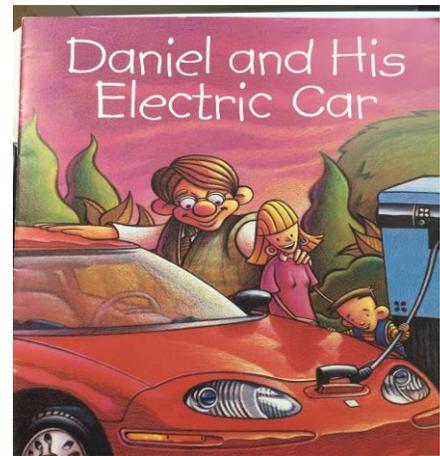
- 6.3.4.A.3
- 6.3.4.B.1

#### Health/PE

- 2.1.2.C.2
- 2.1.2.D.[1 & 3]
- 2.1.4.C.[1 & 2]
- 2.1.4.D.[1 & 3]
- 2.2.2.B.2
- 2.2.4.A.1
- 2.2.4.B.[1 & 2]
- 2.5.2.C.[1 & 2]

#### Life & Career Skills

- 9.1.4.A.1
- 9.1.4.B.1
- 9.1.4.C.1
- 9.1.4.D.1
- 9.1.4.F.3



## Cars from the Future

Grade(s): 4-5



### Learning Objectives

Students will be able to:

- Explain that cars contribute to air pollution by emitting pollutants that impact both human and environmental health
- Explain that engineers help people by designing new cars that produce fewer emissions
- Describe why it is important for engineers to be able to present their ideas

### Overview

Students will be provided with a brief presentation on a variety of technologies. Following the presentation, students will be invited to work in to use their imagination to design eco-friendly cars using the engineering design process, and make their own presentations to the class to showcase their design (how their car is powered, why it is better for the environment).

### Complementary Follow Up Activities

- Students can build a model car from their designs
- Students choose one of the eco-friendly technologies used in their designs and further research how and where the technology is being used. Each group can pick a different technology and develop a presentation to share key features with the class

### Curriculum Standards.

#### **Social Studies**

- 6.1.4.A.15
- 6.1.4.B.5
- 6.1.4.B.9
- 6.1.4.C.12
- 6.1.4.C.15
- 6.1.4.C.16

#### **Science**

- 5.1.4.D.1
- 5.1.4.D.2
- 5.2.4.C.1
- 5.2.4.E.3

#### **Life & Career Skills**

- 9.1.4.A.[2 - 5]
- 9.1.4.C.1
- 9.1.4.D.1

#### **Technology**

- 8.2.4.A.1
- 8.2.4.B.2
- 8.2.4.B.3
- 8.2.4.G.3

# Drive it Green

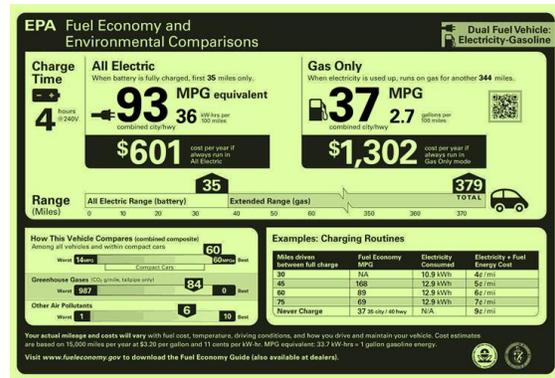
Grade(s): 5-8

## Learning & Activity

### Goals/Objectives

Students will be able to:

- Rank the importance of several car buying considerations
- Discuss fuel efficiency and what it means for the environment and our wallet
- Understand how transportation choices can impact the environment
- Understand that there are other types of fuel that can power motor vehicles



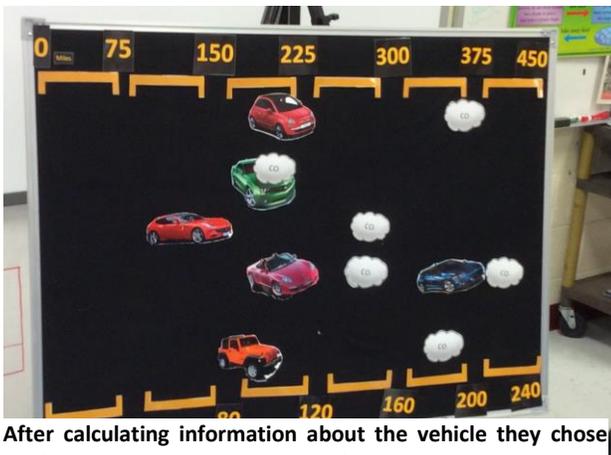
## Overview

Students start out the lesson by looking at a list of seven (7) reasons that a person might consider when purchasing a vehicle (color, style, brand name, etc.)

Students are then broken out into teams and directed to select a vehicle (sports car, sedan, pick-up truck, etc) that they will utilize for the remainder of the class period. Students are asked to select their vehicle prior to being given any further information about the activity.



Students look over the window sticker information about their vehicle choice.



After calculating information about the vehicle they chose students plot their vehicle and pollution on a graph.

Only after the student teams have selected their vehicles are they provided with a "window sticker" which will give them additional information, such as gas mileage, EPA ratings, etc.

Student are then given a "mock allowance" of \$30 to spend on fuel for their vehicle. Then are then asked to calculate how far they will

be able to travel using the \$30 worth of fuel. Students will also calculate how much pollution their vehicle will generate using \$30 worth of fuel.

Finally, the teams compete against each other on a "race board", placing their vehicles along a chart to how far their vehicle traveled on \$30 worth of gas and also how much CO<sub>2</sub> their car emitted.

Students will also be involved in a discussion about alternative forms of transportation and alternative fuels for vehicles.



Students participate in a discussion about the alternative fuel vehicles.

### Curriculum Standards

#### **Health & Physical Education**

##### Grade 6

- 2.1.6.A.2
- 2.1.6.D.1
- 2.2.6.A.1
- 2.2.6.B.1
- 2.2.6.D.2

##### Grade 8

- 2.1.8.A.2-3
- 2.1.8.C.2
- 2.2.8.D.1-2

#### **Science**

- 5.1.8.A.1
- 5.1.8.A.2
- 5.1.8.C.1
- 5.1.8.C.2
- 5.1.8.D.1
- 5.2.8.C.2

#### **Technology**

- 8.2.4.B.3

#### **Social Studies**

- 6.3.8.A.1

#### **Life & Career Skills**

- 9.1.8.A.2
- 9.1.8.B.[1 & 2]
- 9.1.8.D.3

#### **Mathematics**

- CCSS.Math.Practice.MP4
- CCSS.Math.Practice.MP7
- CCSS.Math.Content.6.NS.B.3

## Junior Solar Sprints

Grade(s) 6-8

### Overview

Junior Solar Sprints is a competition based program in which students design, build and race a solar powered model car.

Students are provided with the basic materials required to build their race cars

including the wheels, axels, gears, motors, and solar panels. Beyond these materials, students can use anything they like to build their vehicle. The only two required materials that must be used are the solar panel and motor, everything else is fair game.

The culmination of the work done by the students throughout the year is the district race day that is held in May at a local Hunterdon County school.



Students from around the county who are participating in their local schools come together to compete and race their vehicles against one another. Student's cars are judged in five different categories: speed, craftsmanship, engineering, best use of recycled materials, and documentation portfolio. Winners in each of these categories are invited to the JSS regional competition between the winners from the other five (5) regional races.

Junior Solar Sprints is a terrific S.T.E.M. (Science, Technology, Engineering, and Math) activity for your students and can be incorporated into the curriculum as an in class or after school project.

### Curriculum Standards

#### Science

- 5.1.8.A.[1&2]
- 5.1.8.B.2
- 5.1.8.C.[2&3]
- 5.1.8.D.[2&3]
- 5.2.8.C.2
- 5.2.8.D.1
- 5.2.8.E.[1&2]

#### Life & Career Skills

- 9.1.8.A.[1&2]
- 9.1.8.C.[1-3]

#### Visual & Performing Arts

- 1.1.5.D.1
- 1.3.8.D.[1&2]
- 1.3.8.D.6

#### Technology

- 8.1.8.A.1
- 8.1.8.B.1
- 8.2.8.B.[1&3]
- 8.2.8.E.1
- 8.2.8.F.1

#### Mathematics

- CCSS.Math.Practice.MP4
- CCSS.Math.Practice.MP7
- CCSS.Math.Content.6.NS.B.3
- CCSS.Math.Content.6.G.A.4
- CCSS.Math.Content.7.G.B.[1&6]
- CCSS.Math.Content.8.G.B.7

## Junior Solar Sprints Series: Basics of Designing & Building Your Model Car

Grade(s): 6-8

### Learning & Activity Goals/Objectives

- What are the basic design strategies
- What are the best materials for strength vs. weight
- How does the structure of my vehicle impact its durability



### Overview

Using a continuous feedback loop of: Ask -> Imagine -> Plan -> Build -> Test and Evaluate, students will learn the steps necessary to successfully build a working model solar vehicle. This information will be extremely important as they move through the stages of building their Solar Sprint cars and developing not only a working vehicle but one that might win the races.

Following the informative lesson, students will participate in a building exercise that will engage them in the building and design of shapes that could help them improve the overall strength of their vehicles without sacrificing added weight.

### Curriculum Standards

#### **Health & Physical Education**

- 2.1.8.A.3
- 2.2.8.A.2
- 2.2.8.B.2
- 2.2.8.C.1

#### **Mathematics**

- CCSS.Math.Practice.MP4
- CCSS.Math.Practice.MP7
- CCSS.Math.Content.6.NS.B.3
- CCSS.Math.Content.6.G.A.4
- CCSS.Math.Content.7.G.B.[1&6]
- CCSS.Math.Content.8.G.B.7

#### **Science**

- 5.2.6.E.3
- 5.1.8.A.2
- 5.1.8.B.[1&2]
- 5.1.8.D.[1-3]

#### **Technology**

- 8.2.8.B.[1-3]
- 8.2.8.E.1
- 8.2.8.F.1

#### **Life & Career Skills**

- 9.1.8.A.1
- 9.1.8.A.4
- 9.1.8.B.1
- 9.1.8.C.[1-3]

#### **Visual Arts**

- 1.3.8.D.1

## Junior Solar Sprints Series: Introduction to Gears & Gear Ratios

Grade(s): 6-8

### Learning & Activity Goals/Objectives

- What is a gear and how does it work
- How do you determine a gear ratio
- What is torque vs. speed and how do they impact the way gears operate



### Overview

What is a gear? How does it work? How does the size of the gear and different gear arrangements impact the overall performance of the gears?

In this lesson we answer all of these questions and more. Students will be introduced to gears, and gear ratios. Students will also learn about torque and speed and how to determine if the gear ratio that they are using is utilizing either of these.

The second part of the lesson, after the students are familiarized with gear ratios, focuses on how to incorporate these concepts into their Junior Solar Sprints vehicles. During this portion of the lesson we will discuss how wheel size directly impacts the gear ratio needed to move the vehicle and how to best find the proper ratio to use.

### Curriculum Standards

#### **Health & Physical Education**

- 2.1.8.A.3
- 2.2.8.A.2
- 2.2.8.B.2
- 2.2.8.C.1

#### **Mathematics**

- CCSS.Math.Practice.MP4
- CCSS.Math.Practice.MP7
- CCSS.Math.Content.6.NS.B.3
- CCSS.Math.Content.6.RP.A.[1-3]
- CCSS.Math.Content.7.RP.A.[2-3]

#### **Science**

- 5.1.8.A.2
- 5.1.8.B.[1&2]
- 5.1.8.D.[1-3]
- 5.2.8.E.1

#### **Life & Career Skills**

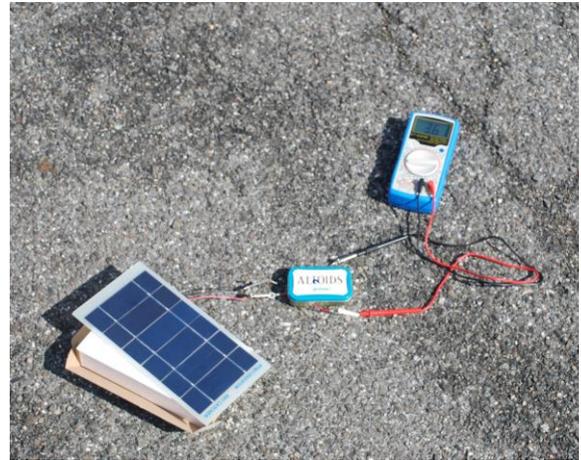
- 9.1.8.A.1
- 9.1.8.A.4
- 9.1.8.B.1
- 9.1.8.C.[1-3]

## Junior Solar Sprints Series: Solar Power!

Grade(s): 6-8

### Learning & Activity Goals/Objectives

- How does the sun move across the sky
- How does a solar panel work
- Does the angle of the solar panel relative to the positioning of the sun impact the efficiency of the panel



### Overview

Does the angle of my solar panel really impact the power output that much? Find out with this lesson that is designed to test that exact question. We will review the basics when it comes to solar energy generation; the distance from the earth to the sun, the path of the sun across the sky, how a solar panel works, and how to choose the best angle when looking to use solar power on a stationary object.

Utilizing a solar panel, multimeter and a protractor students will investigate how the angle of the solar panel, relative to the sun's position, impacts the output of the solar panel. By taking measurements at different angles the students will get to see the importance of being able to move their solar panel towards the sun during the races.



### Curriculum Standards

#### **Health & Physical Education**

- 2.1.8.A.3
- 2.2.8.A.2
- 2.2.8.B.2
- 2.2.8.C.1

#### **Mathematics**

- CCSS.Math.Practice.MP4
- CCSS.Math.Practice.MP7
- CCSS.Math.Content.6.NS.B.3

#### **Science**

- 5.1.8.A.2
- 5.1.8.B.[1&2]
- 5.1.8.D.[1-3]
- 5.2.8.C.2
- 5.2.8.D.2
- 5.2.8.E.1
- 5.4.8.C.3

#### **Life & Career Skills**

- 9.1.8.A.1
- 9.1.8.A.4
- 9.1.8.B.1
- 9.1.8.C.[1-3]

## Junior Solar Sprints Series: Aerodynamics

Grade(s): 6-8

### Learning & Activity Goals/Objectives:

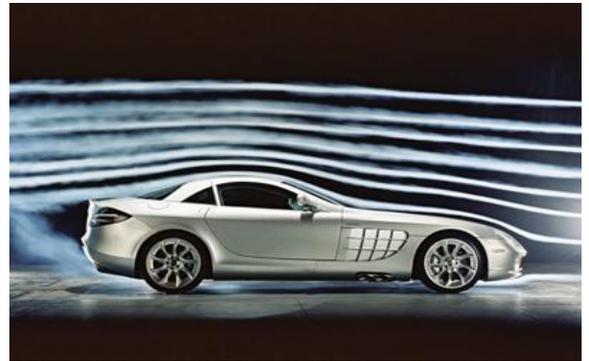
- What is Aerodynamics? How does it impact my vehicle?
- How can I make aerodynamics work for me



### Overview

How does the aerodynamics, or shape, of an object moving through the air increase or decrease the friction (drag) on that object? In this lesson we explore the four (4) forces of aerodynamics: Lift, Weight, Thrust, and Drag. We will discuss these different forces and describe how each of them works with or against a vehicle.

For the experimental portion of this lesson students will be asked to design, using foam pieces, different shaped objects that will be put into a homemade wind tunnel to test how they interact with the air. Using a spring scale students will attach their shapes into the wind tunnel and record the amount of drag that is being placed on their shapes.



### Curriculum Standards

#### **Health & Physical Education**

- 2.1.8.A.3
- 2.2.8.A.2
- 2.2.8.B.2
- 2.2.8.C.1

#### **Mathematics**

- CCSS.Math.Practice.MP4
- CCSS.Math.Practice.MP7
- CCSS.Math.Content.6.NS.B.3
- CCSS.Math.Content.6.G.A.4
- CCSS.Math.Content.7.G.B.6
- CCSS.Math.Content.8.G.B.7

#### **Science**

- 5.2.6.E.3
- 5.1.8.A.2
- 5.1.8.B.[1&2]
- 5.1.8.D.[1-3]
- 5.2.8.E.1

#### **Technology**

- 8.2.8.B.[1-3]

#### **Life & Career Skills**

- 9.1.8.A.1
- 9.1.8.A.4
- 9.1.8.B.1
- 9.1.8.C.[1-3]

## Junior Solar Sprints Series: At the Race Line

Grade(s): 6-8

### Learning Objectives

- Why do we attach our cars to a race line?  
What is the race line and what does it do?
- How do I attach and un-attach my vehicle easily from the race line.



### Overview

Race line attachment is a consistent challenge for students on race day. Student vehicles must attach (and remain attached or they are disqualified from that race) to a 60# fishing wire that stretches the length of the track. This lesson will help your students feel more confident and understand what they need to do prior to race day.

Utilizing simply designed balloon powered cars with different race line attachments students will have the opportunity to experiment with different set-ups to find one that would work well with the design of their vehicle.

### Curriculum Standards

#### **Health & Physical Education**

- 2.1.8.A.3
- 2.2.8.A.2
- 2.2.8.B.2
- 2.2.8.C.1

#### **Mathematics**

- CCSS.Math.Practice.MP4
- CCSS.Math.Practice.MP7
- CCSS.Math.Content.6.NS.B.3
- CCSS.Math.Content.6.G.A.4
- CCSS.Math.Content.7.G.B.6
- CCSS.Math.Content.8.G.B.7

#### **Science**

- 5.2.6.E.3
- 5.1.8.A.2
- 5.1.8.B.[1&2]
- 5.1.8.D.[1-3]
- 5.2.8.E.1

#### **Technology**

- 8.2.8.B.[1-3]

#### **Life & Career Skills**

- 9.1.8.A.1
- 9.1.8.A.4
- 9.1.8.B.1
- 9.1.8.C.[1-3]

## Junior Solar Sprints Series: What to Expect on Race Day

Grade(s): 6-8

### Lesson Objectives

- Making the students feel comfortable with what will be happening on Race Day.
- Providing and last minute fixes, and tweaks to vehicles.



### Overview

This workshop can be tailored to the specific needs of your students. The lesson will provide your students' with specific information about what to expect on race day, what to do, where to go, and how the event works. The main goal of this lesson is to make sure your students and their vehicles are ready to race on race day.

This may include answering last minute questions, soldering/wire connections, vehicle inspection to provide useful tips for students, and test race line for students to test their vehicles.

### Curriculum Standards

#### **Science**

- 5.1.8.A.[1&2]
- 5.1.8.B.2
- 5.1.8.C.[2&3]
- 5.1.8.D.[2&3]
- 5.2.8.C.2
- 5.2.8.D.1
- 5.2.8.E.[1&2]

#### **Life & Career Skills**

- 9.1.8.A.[1&2]
- 9.1.8.C.[1-3]

#### **Visual & Performing**

#### **Arts**

- 1.1.5.D.1
- 1.3.8.D.[1&2]
- 1.3.8.D.6

#### **Technology**

- 8.1.8.A.1
- 8.1.8.B.1
- 8.2.8.B.[1&3]
- 8.2.8.E.1
- 8.2.8.F.1

#### **Mathematics**

- CCSS.Math.Practice.MP4
- CCSS.Math.Practice.MP7
- CCSS.Math.Content.6.NS.B.3
- CCSS.Math.Content.6.G.A.4
- CCSS.Math.Content.7.G.B.[1&6]
- CCSS.Math.Content.8.G.B.7



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