

INSPIRE GK12 Lesson Plan



Lesson Title	Charles's Law
Length of Lesson	30 minutes
Created By	Lucas Pounders
Subject	Physical Science
Grade Level	9 th - 12 th
State Standards	1b,c,g; 2b,c
DOK Level	1,2,3,4
DOK Application	Recognize, observe, conclude, connect
National Standards	9-12 Science as Inquiry
Graduate Research Element	Volume and Temperature

Student Learning Goal:

This lesson is designed to help students to understand the significance of Temperature and Volume as it pertains to Charles's Law. This will be done through the use of visual aids and lecture with discussion.

State Standards

INQUIRY

1. Apply inquiry-based and problem-solving processes and skills to scientific investigations.
 - b. Identify questions that can be answered through scientific investigations.
 - c. Identify and apply components of scientific methods in classroom investigations.
 - g. Communicate effectively to present and explain scientific results, using appropriate terminology and graphics.
2. Describe and explain how forces affect motion.
 - b. Explain the connection between force, work, and energy.
 - c. Describe (with supporting details and diagrams) how the kinetic energy of an object can be converted into potential energy (the energy of position) and how energy is transferred or transformed (conservation of energy).

National Standards

9-12: Science as Inquiry Standards: Understanding about scientific inquiry

*Boyle's Law is an established law explaining the relationship between volume and pressure.

Materials Needed (supplies, hand-outs, resources):

Working knowledge of Charles's Law

Heat source (Preferably Bunsen Burner)



Erlenmeyer flask with stopper
Hose connected to flask
Rubber glove connected to hose
Liquid Dish Soap
Water
Natural Gas Source with attached hose
Beaker

Lesson Performance Task/Assessment:

Start by asking the students what they know about temperature and volume. Next ask the students what they know about Charles's Law. Explain to them a generic example of $(T1/V1)=(T2/V2)$. Ask the students to describe the glove at its current state before the system is heated. Allow the erlenmeyer flask to be placed over the heat source and ask the students to draw and explain in their own words the system before the heat was placed on the flask. After the glove is inflated ask the students to draw and explain the system again. Discuss their findings with them. Take the hose attached to the gas source and place it into a beaker filled with liquid dish soap and water. Ask the students to explain to you what they see. Then explain to them that the bubbles are filled with natural gas and not regular air. Ignite the bubbles with the burner or other flame source. (Attempt this before the class with a small amount of bubbles first to make sure of the amount you will need for a good sized sample.) The bubbles will ignite forming expanded gas and relating it to Charles's Law. Ask the students to draw and explain what they have seen.

Lesson Relevance to Performance Task and Students:

This lesson is designed to allow the students to ask questions and make their own assumptions about what is happening in the presented scenarios. It is then to be followed up with facts about how the systems and how they work. In the end the students should have an understanding of the true correlations between temperature and volume as defined by Charles's law.

Anticipatory Set/Capture Interest:

The anticipatory set used in this lesson comes in the from the questions asked at the beginning of the lesson. It also provides exciting visual for the students to allow them to see the effects that Boyle's law can have on in different systems.

Guided Practice:

This activity is done in a way that allows students to ask questions about the problem at hand as needed and come up with their own questions to find the answers.

Independent Practice:

Students can be given handouts associated with Charles's law from their textbooks or other resources. They are also asked to write down and draw their own opinions of what



is happening in each experiment as they are happening for discussion. These opinions are to be turned in at the end of the lesson or after elaborating on their opinions.

Remediation and/or Enrichment:

Follow student IEP.

Check(s) for Understanding:

Ask the students both at the beginning, in the middle and at the end of class for their understandings of temperature, volume and Charles's Law. Their answers to these questions should show insight into their understanding of the subject material.

Closure:

Closure comes in the form of class discussion where the answer to questions asked for understanding can be left somewhat open ended or have a correct and definite answer. Also the students are to turn in their own opinions of the experiments and how Charles's Law applies. These should be applicable interpretations.

Possible Alternate Subject Integrations:

Most all areas of science.

Teacher Notes:

Always be sure to run experiments before trying to attempt them in class. These experiments worked best in the order as they are represented here. Do not be afraid to substitute and improvise as needed.