Gas Laws - A Computational Approach

Boyle's Law

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Purpose
In this lesson students will determine the relationship between the pressure and volume of a gas (Boyle’s Law).

Overview
This activity provides a differentiated approach through various modalities to investigate Boyle’s Law. We designed this lesson for a low achieving chemistry class. The three approaches allow your students to utilize their computational thinking strategies to define Boyle’s Law. First, a hands-on approach that allows students to physically manipulate gasses and make predications. The second computational approach uses the NetLogo environment to simulate gas behavior to make predications. Last, students make a graph from provided data to make their predictions. As the classroom teacher, you are able to allow each student to begin at their appropriate readiness level.

Student Learning Targets
Boyle’s Law

• I can define pressure and volume in regards to gasses in a container.
• I can define the relationship between volume and pressure for a fixed amount of gas (Boyle's Law).
• I can predict the change in pressure if the volume is changed for a fixed amount of gas.
• I can calculate the change in pressure or volume if given the initial values and one new variable.

Computational Thinking

• Data & Information (Manipulating Data, Analyzing Data, Visualizing Data)
• Computational Modeling (Using a model to identify/test solutions)

Time
One to two 42 minute periods.
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Level
High School Basic Chemistry – Differentiated for different readiness levels.

Materials and Tools
- Soccer ball
- Air pump
- Mini-vacuum pump
- Balloons
- Various items for manipulations (marshmallows, shaving cream, water)
- Computer with internet and NetLogo
- Handout: Gas Laws – A Computational Approach

Preparation
Students will need instructions on how to access NetLogo in your computer environment.

Prerequisites
None

Background
There are three major phases of matter. Their properties are determined by the amount of energy the particles contain. Solid matter has lower energy and the particles move in place. Liquid matter has more energy and the particles can move past one another and fill the bottom of a container. Matter in the gaseous phase has the most energy and will fill the container.

Teaching Notes
It is important to make sure the students are understanding that the hits on the sides of a container are equal to pressure in the computational investigation.

Assessment
Formative assessments as you move through the assignments. The discussion questions from the Introductory Investigation will allow you to gauge their mastery of the relationship between volume and pressure. As the students move through the computational investigation they will make predictions for the change in pressure if the volume is changed for a fixed amount of gas. The mathematical investigation will provide questions to assess the students’ mastery on Boyle’s law.