Teacher Introduction:

The Simulation - *Ideal Gas Law gizmo from ExploreLearning.com*

Credit to Jennifer Buffie & Julia Matter for this effort.

This simulation does not specifically address the Ideal Gas Law, rather it addresses two components of the Law, Boyle's Law and Charles' Law of gas behaviour. This is done with two separate, yet similar simulations. Thus, this activity serves as an excellent foundation to prepare students to learn the Ideal Gas Law.

In the Boyle's Law simulation, users can observe the relationship between pressure and volume of an ideal gas at a fixed temperature. The simulation consists of a sealed container containing gas particles, topped with a movable lid. The temperature is adjustable, but must be fixed before the other variables (lid mass or container volume) may be manipulated. In the activity, students will be applying and removing weights to the lid of the container to lower and raise it, which increases and decreases the volume of the system. The change in volume acts to increase or decrease the pressure of the system. These changes in volume and pressure can immediately be seen on the screen in a numeric display as well as on a bar graph. Users can record changes in volume and pressure in a table for consecutive trials. At the same time, a line graph can be generated to represent the data.

In the Charles' Law simulation, users employ the same closed container system to observe the relationship between volume and temperature of an ideal gas at a fixed temperature. In this situation, the mass of the lid is adjustable, but must be fixed before the other variable (temperature) may be manipulated. Users may then change the temperature of the system and observe the corresponding changes in the volume of the container. Again, these results are displayed directly on the screen as well as in tabs displaying a bar graph, data table and line graph.

The Activity

Students will be provided with a detailed worksheet consisting of step-by-step procedures and questions to guide them through the simulations. This worksheet will ensure students can work through the activity independently (although they will be encouraged to work in pairs) and in a logical manner to ensure they understand the concepts addressed. Using the worksheet, students are initially permitted to experiment at will with the systems' variables. They then move through guided manipulations and record their observations on the worksheet and the data table within the simulation. Finally, they use the data they have collected and generate a graph depicting the relationship between the variables in question. They are then guided to a final statement of the law in question. This is done in two consecutive parts of the activity: first for Boyle's Law and then for Charles' Law. At the end of the activity, students return to the objectives laid out at the beginning of the exercise and summarize what they have learned. Review questions complete the activity. If students have successfully mastered the concepts presented in this activity, only a brief formal lesson with note taking should be necessary. Note: we have purposely not addressed the calculations aspect of these two laws in order to provide students with a straightforward, uncomplicated picture of the foundational concepts of the Ideal Gas Law. Calculations would be a next logical step once students have a firm grasp on the relationships between the variables presented (and the applicable equations).

Rationale