Name: _____

Unit 9: Thermodynamics

LAB: Analysis of Pressure-Volume Diagrams

Objectives:

Learning Objective 5.B.7.1: The student is able to predict qualitative changes in the internal energy of a thermodynamic system involving transfer of energy due to heat or work done and justify those predictions in terms of conservation of energy principles.

Learning Objective 5.B.7.2: The student is able to create a plot of pressure versus volume for a thermodynamic process from given data.

Learning Objective 5.B.7.3: The student is able to use a plot of pressure versus volume for a thermodynamic process to make calculations of internal energy changes, heat, or work, based upon conservation of energy principles (i.e., the first law of thermodynamics.)

Setup: Go to the PhET simulation "Gas Properties" at http://phet.colorado.edu/en/simulation/gas-properties. You will need to use the layer tool and the ruler to determine volume. Pull the layer tool to the top of the container to get the container height. Assume the depth of the container is the same as its height. It is important that you make this a closed system. Do not add or remove gas. *Hint: When making change, go slowly and then wait for the sim to stabilize before taking readings and moving onto the next change.*

1. Isothermal Process:

- Qualitatively describe what your procedure would be to create an isothermal process in the real world.

- Without worrying yet about quantitative data create an isothermal change using the sim. (The temperature MUST stay as close to constant during this process as you can possibly make it.) What did you have to do in order to make this happen?

- Now repeat your procedure taking P & V data for at least 5 points. Use Excel to create a data table and a graph. Print and attach these to this lab.
- Using your graph, calculate an approximate value for the work done on the gas. Then explain how this relates to the change in terms of $\Delta U = Q + W$.

2. Isobaric Process:

- Qualitatively describe what your procedure would be to create an isobaric process in the real world.

- Without worrying yet about quantitative data create an isobaric change using the sim. What did you have to do in order to make this happen?

- Now repeat your procedure taking P, V, & T data for at least 5 points. Use Excel to create a data table and a graph. Print and attach these to this lab.
- Using your graph, calculate an approximate value for the work done on the gas. Then explain how this relates to the change in terms of $\Delta U = Q + W$.

2. Isochoric Process:

- Qualitatively describe what your procedure would be to create an isochoric process in the real world.

- Without worrying yet about quantitative data create an isochoric change using the sim. What did you have to do in order to make this happen?

- Now repeat your procedure taking P, V, & T data for at least 5 points. Use Excel to create a data table and a graph. Print and attach these to this lab.
- Using your graph, calculate an approximate value for the work done on the gas. Then explain how this relates to the change in terms of $\Delta U = Q + W$.