Simple Engine Lab
Date:_____ Period:_____ Group Number:_______ Name:________________________
Names of other group members present:
________________ ________________ ________________ ________________

Include your name, date, group number, and class period at the top of each sheet of work in your lab report. Include the names of the other members of your lab group who were present for data collection.
Keep a reference copy of your work as a study guide.

1. While the engine is still cold, begin measuring the volume of air trapped inside. DO NOT disassemble any part of the engine, but use the best measurements and estimates that you can make of its internal dimensions to calculate the air volume.

2. Record the ambient room temperature before heating the engine.

3. Place the engine so that the end with the hook (the “cold” end) is facing outward, toward the edge of the table, so that the hot end of the engine will be in toward the middle of the table. Be VERY CAREFUL when you ignite the fuel, and PAY CONSTANT AND CAREFUL ATTENTION for as long as the fuel is burning. Remember where the fire extinguisher and fire blanket are in case of a fire emergency.

4. While the burning fuel heats the air trapped inside the engine, observe the expansion of the flexible balloon supporting the “cold” end of the engine. Estimate as carefully as you can how much the air volume increases by the time it reaches its maximum.

5. Use the metal washers as weights added to the hook at the “cold” end of the engine to try to find the right balance that will keep the engine driving itself back and forth as the air inside is shifted from the hot end to the “cold” end by the moving spacers, to alternately expand and contract.

6. Use the ambient room temperature, trapped air volume, and atmospheric pressure to calculate the number of moles of air trapped in the engine, and to calculate the initial internal thermal energy of the trapped air.

7. Use the calculated number of moles of air, atmospheric pressure, and the maximum volume to calculate the maximum internal temperature and the maximum internal thermal energy of the air trapped in the engine.

8. Use the calculated number of moles of air and the ambient room temperature to calculate hypothetical pressures for the same air sample at the same temperature in volumes of 10.0×10^{-6} m^3, 20.0×10^{-6} m^3, and 30.0×10^{-6} m^3.

9. Use the calculated number of moles of air and the calculated maximum internal air temperature to calculate hypothetical pressures for the same air sample at the same temperature in volumes of 10.0×10^{-6} m^3, 20.0×10^{-6} m^3, and 30.0×10^{-6} m^3.

10. Make a clear and informative data table to organize and present your experimental and hypothetical volumes, temperatures, pressures, and the calculated number of moles of air trapped in the engine. Use a separate table to organize your measured dimensions in relation to your calculated volumes.

11. Make one graph of pressure (dependent variable) versus volume (independent variable) to plot all eight pairs of pressure and volume data. Connect the four points based upon maximum temperature to each other. Connect the four points based upon initial ambient room temperature to each other. Label each group according to the temperature used in its calculations.

12. Describe how the work done by the air expanding at constant pressure is related to the graph.
Also describe the relationship of the internal thermal energy for each point on the graph in comparison with the other points connected along the same “path” of constant temperature along the graph.