GE U111 ENGINEERING PROBLEM SOLVING & COMPUTATION, SPRING 2004
HOMEWORK #4 – IDEAL GAS EQUATION

DATE ASSIGNED:	February 9, 2004
DATE DUE:	February 19, 2004 (at the beginning of class)
READING:	Chapter 4 (JK)

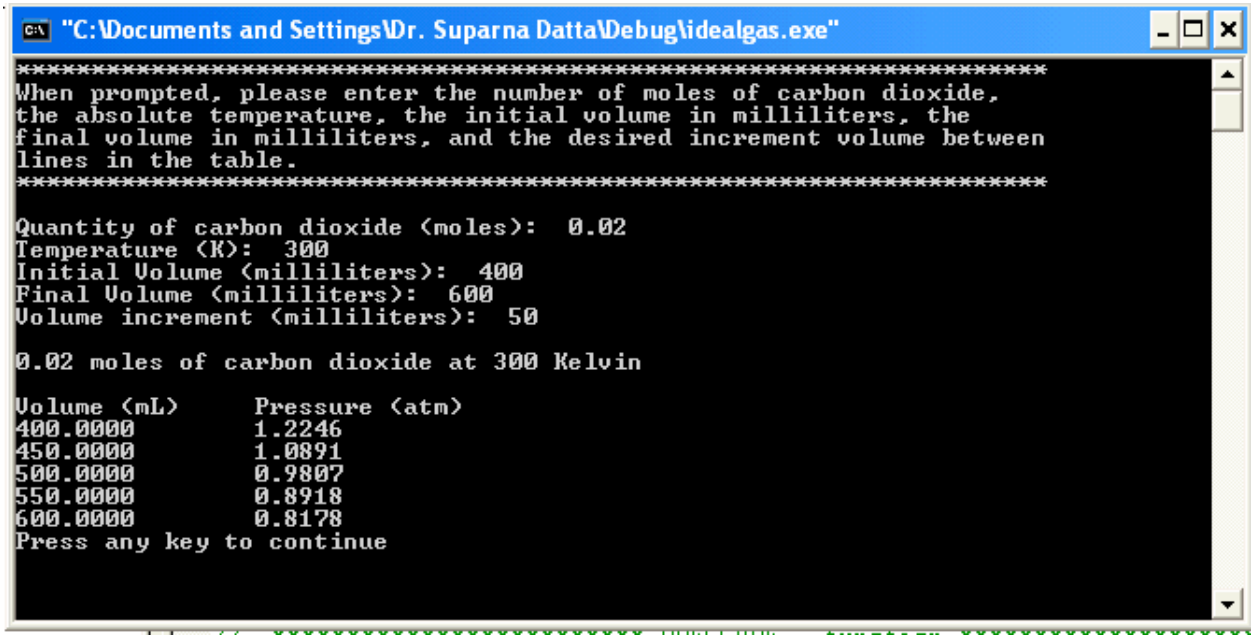
The pressure of a gas changes as its volume and temperature varies. We are all familiar with the ideal gas equation of state which relates pressure, specific volume, and temperature. Namely, PV = nRT , where P is the pressure, V is the specific volume, n is the quantity of gas, R is the gas constant, and T is the absolute temperature. In fact, there are many other equations of state used to describe the relationship between P, V, and T. Another common one is the Van der Waals equation of state, given as:

$$\left(P + \frac{an^2}{V^2}\right)\left(V - nb\right) = nRT$$

where:

P = Pressure (atmospheres, atm)
V = Volume (L)
T = Temperature (K)
R = Gas Constant = 0.08206 (L*atm) / (mol * K) for Carbon Dioxide
a = 3.592 (L^2*atm) / mol^2 for Carbon Dioxide
b = 0.0427 L / mol for Carbon Dioxide
n = number of moles (mol)

Write a program that will use the Van der Waals equation of state to display in tabular form the relationship between P, V, and T for Carbon Dioxide. Inputs to the program include n, the temperature in K, the initial and final volumes in milliliters, and the volume increment between lines of the table. Your program will display a table that varies the volume of the gas from the initial to final volume in steps prescribed by the volume increment. A sample run should like this:



1. Write pseudocode or make a flowchart for this problem. Call your program "HW4*xxx*.cpp", where *xxx* are your initials. **Your program must include and use a function (i.e., a function that you have written into the code) in order to receive full credit for this assignment.** Be sure to **document** your source file; in particular, be sure to note what your function(s) actually do. **Test your program for the case given in the aforementioned example and for 3 other cases of your choosing (be sure to change all of the input values for each of the additional 3 sample runs).** Print out what appears on the (4) terminal windows (use ALT + PRINT SCREEN).

2. Submit the following items in a folder properly labeled and bound. Be sure that both your name and class section appear on the front of the folder. Assignments presented otherwise will be returned with penalty.
    a. Correspondence page (cover letter, memo, fax sheet)
    b. List of contents
    c. Flowchart or pseudocode
    d. Printed copy of your commented source file (HW4*xxx*.cpp)
    e. Printouts of terminal windows for the four cases specified above
    f. Diskette with program files (HW4*xxx*.cpp)

3. Email a copy of your program file (HW4*xxx*.cpp) to Stephen Frechette at sfrechet@ece.neu.edu before the start of class on February 19th. In the subject line, type the following: "Your last name, GE U111-Section 1, HW 4".