ASSIGNMENT 7

CHEMISTRY 200

Due: 4:30 pm Wednesday 5 November 2008

The Isothermal Work Assignment

In all cases below, the system consists of 1.40 mol of gas at a temperature of 158 K and has an initial volume of 10.33 L.

Five equations of state will be considered.

A. The perfect gas:

$$p = \frac{RT}{\overline{V}}$$

B. The hard-sphere gas:

$$p = \frac{RT}{\overline{V} - b}$$

with $b = 83.13$ cm^3 mol^{-1}.

C. The van der Waals gas:

$$p = \frac{RT}{\overline{V} - b} - \frac{a}{\overline{V}^2}$$

with $a = 0.3271$ dm^6 atm mol^{-2} and $b = 53.43$ cm^3 mol^{-1}

D. The Berthelot gas:

$$p = \frac{RT}{\overline{V} - b} - \frac{a}{T\overline{V}^2}$$

with $a = 1358.13$ dm^6 atm K mol^{-2} and $b = 44.21$ cm^3 mol^{-1}

E. The virial equation:

$$p = \frac{RT}{\overline{V}}\left(1 + \frac{B}{\overline{V}} + \frac{C}{\overline{V}^2}\right)$$

with $B = -4.38 \times 10^{-4}$ m^3 mol^{-1} and $C = 4.57 \times 10^{-9}$ m^6 mol^{-2}.

For each of these equations of state, calculate the work associated with each of the following paths:

1. Isothermal reversible expansion to twice the initial volume.
2. Isothermal reversible compression to half the initial volume.
3. Isothermal expansion in a single step at constant pressure to twice the initial volume.
4. Isothermal compression in a single step at constant pressure to half the initial volume.

Show your work (clearly labelled) for each section of this question and complete the summary sheet on the second page of the assignment. Attach the completed summary sheet as the first page of your assignment.

Name:_____ **Student Number:** _____

	1	2	3	4
A				
B				
C				
D				
E				