**Homework C**

**PHY3513** **Due: Friday, February 23, 2018**

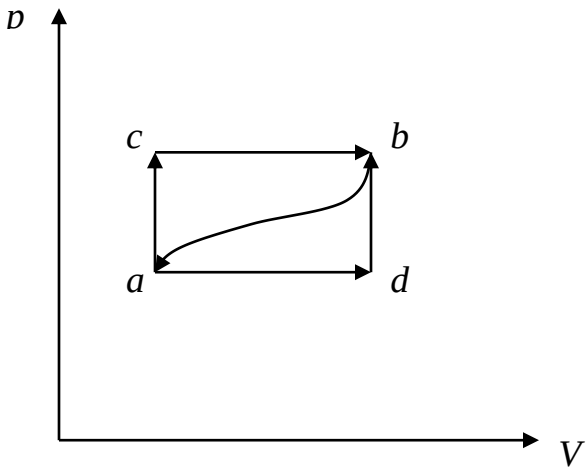
1. (a) problem 6.1; (b) Calculate the average distance between the molecules.

2. problem 6.2

3. problem 6.4

4. problem 6.5

5. A gas is contained in a cylinder fitted with a frictionless piston and is taken from the state *a* to *b* along the path *acb* shown in the figure. 80 J of heat flows into the system and the system does 30 J of work.
(a) How much of heat flows into the system along the path *adb* if the work done by the gas system is 10 J.
(b) When the system is returned from *b* to *a* along the curved path, the work done on the system is 20 J. What is the heat transfer?
(c) If $U_a = 0$ and $U_d = 40$ J, find the heat absorbed in the processes *ad* and *db*.




If you believe in the 1st law of thermodynamics, this becomes just a bookkeeping problem. Note that $\Delta U = U_b - U_a$ remains the same regardless of the path taken. Why?

6. (11.1)

7. (11.2) Start with the expression: $C_p - C_V = R$.

8. (12.2)

9. (12.6) Since this oscillation occurs adiabatically, $pV^{\gamma} = \text{const}$. This leads to $\frac{dp}{p} = -\gamma \frac{dV}{V}$. Now express the quantities appearing in this equation in terms of $x$ (position of the ball from the equilibrium position in the column). In the second part, the gravitational potential energy is converted into the elastic potential energy when the ball falls down. In Eq 12.41 of the text the '8' in the denominator should be replaced by a '2'. You already calculated the air spring constant in the first part.

10. **Rubber Band** The equation of state of rubber band is

$$F = aT\left[\frac{L}{L_o} - \left(\frac{L_o}{L}\right)^2\right]$$

where $L_o$ is the original length (10 cm), $T$ is temperature in Kelvin, $F$ is tension of the rubber band, and $a = 1.3 \times 10^{-2}$ N/K.

(a) How much work is performed when the band is stretched isothermally and reversibly from its original length of 10 cm to 20 cm. The temperature is kept at 293 K.

(b) The rubber band kept at a constant length stretched. Will the tension increase when temperature rises?

(c) The rubber band is stretched under a constant tension. Will it shrink when you warm the rubber band?