Sixth Problem Set Phy132
Due Friday, May 31

Note: Problem 4 and 5 are not required, since we most likely won't be covering thermal conductivity.

Problem 1.
At room temperature and atmospheric pressure, N_2 has an R.M.S. velocity of 511 m/s. What is the R.M.S. velocity of He under the same conditions?

Problem 2.
The best vacuum that can be produced in the laboratory is around 10^{-18} atmospheres. How many molecules are there per cubic centimeter at room temperature (300° K)?

Problem 3.
The pressure P, volume V, and temperature T for a certain substance are related by the equation:

$$P = \frac{AT - BT^2}{V} \tag{1}$$

In this equation, A and B are constants. Find an expression for the work done by the material if the temperature changes from T_1 to T_2 for an isobaric process.

Problem 4.
A glass window pane has an area of 1 m^2, and a thickness of 6 mm. The temperature outside is 40°C, and the temperature inside is 20°C. How much energy (heat) flows through the window pane each hour?

Problem 5.
A bar of gold is in thermal contact with a bar of silver of the same area. The length of the gold bar is 2 cm, and the length of the silver bar is 4 cm. The end of the gold bar is kept at 80°C, and the end of the silver bar is kept at 20°C as shown on the figures page.

When the heat flow reaches steady state, what is the temperature at the junction where the gold and silver meet?

Problem 6.
A container contains one mole of He is initially at a temperature of 300°K, and

a volume of 2×10^{-3} m^3. Another container contains one mole of O_2 also at a temperature of 300°K and a volume of 2×10^{-3} m^3. For each container, the volume is reduced adiabatically to a volume of 10^{-3} m^3. What is the final temperature in each case?

Problem 7.
One mole of an monatomic gas starts off at a pressure of 10^5 Pa, and a volume of 10^{-3} m^3. The pressure is increased at constant volume to a value of 2×10^5 Pa. The gas is then expanded adiabatically to the original pressure. Finally, the gas is compressed at constant pressure to the original state. See the figure on the last page.
Fill in the chart below:

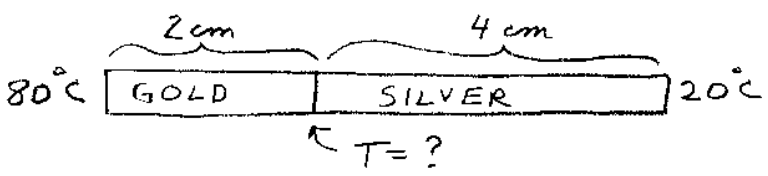
Process	Q	W_{bygas}	ΔU
A to B			
B to C			
C to A			
Complete Cycle			

Problem 8.
Two moles of a monatomic gas are initially at a volume V_1 and a pressure P_1. The pressure and volume slowly doubled to the state with volume $2V_1$ and pressure $2P_1$. The process following a line in the $P-V$ plane as shown in the figure on the last page.

Find the work W done, the heat transfer Q, and the change in internal energy ΔU for the process. Express your answer in terms of P_1, V_1 and R.

Figures for Homework 6

(5)



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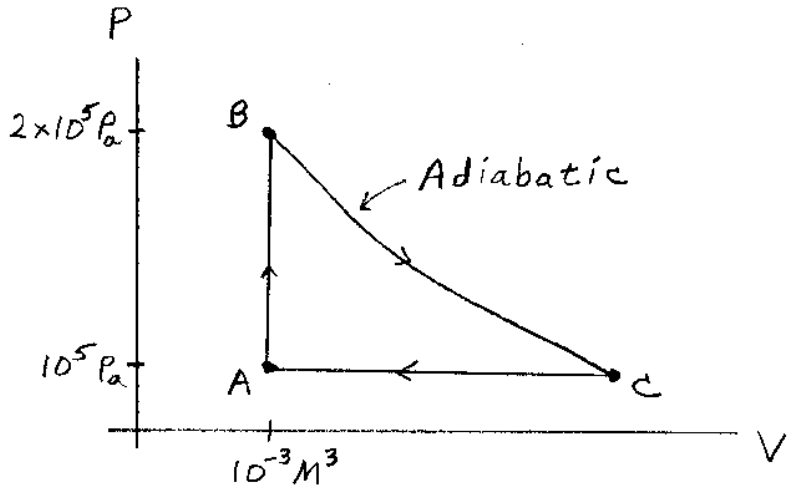

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