Seventh Problem Set Phy132
Due Friday, June 5

Problem 1.
An engine absorbs 1500 Joules and expels 1000 Joules in each cycle. Find:

a)The efficiency of the engine.
b)The work done in each cycle.
c)The power output if each cycle takes 0.4 seconds.

Problem 2.
Wei has a 10 gram ice cube that is at a temperature of $-10°$C. She throws it into the ocean, which is at a temperature of 15°C. What is the entropy change of the universe?

Problem 3.
One mole of O_2 gas is contained in the left side of the container shown in the figure on the last page. Initially, the gas is at a temperature of 300°K, and has a volume of 2 liters. Initially there is a perfect vacuum in the right side of the container, which is also 2 liters in volume. Phuong opens the valve, and the gas occupies both sides of the container.

Find:

a)How much the entropy increased by because of the valve being opened.
b)How much the internal energy changed.
c)The final temperature of the gas.

Assume that the gas behaves as an ideal gas.

Problem 4.
At very low temperatures, the specific heat capacity for some solids is given by the formula:

$$c_v = AT^3 \tag{1}$$

where A is a constant which depends on the material. For aluminum, $A = 7.53 \times 10^{-6}$ cal/(mole K^4). If two moles of aluminum are heated from 4 to 8 degrees K, find:

a)The energy gained by the aluminum.
b)The entropy gained by the aluminum.

Problem 5.
Consider a cycle that consists of isometric and isobaric processes for n moles of a monatomic gas. The gas starts off with a volume V_0 and a pressure P_0 (state a). Then, it is heated isometrically to the state b: volume V_0, pressure $2P_0$. Next it is expanded isobarically to the state c: volume $2V_0$, pressure $2P_0$. Then, it is cooled isometrically to the state d: volume $2V_0$, pressure P_0. Finally, it is compressed isobarically back to the state a. See the figure on the last page.

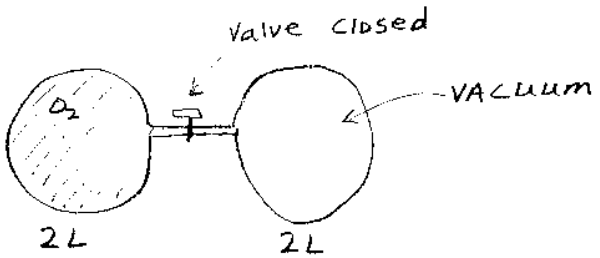
Fill in the chart below:

Process	Q	W	ΔU	ΔS
$a \to b$				
$b \to c$				
$c \to d$				
$d \to a$				
Complete Cycle				

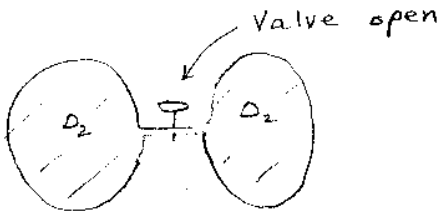
a)What is the efficiency of the engine? How does this compare with the maximum efficiency obtainable for an engine operating between the two temperatures?

Figures for HWK 7

(3)



Initially



Final Situation

(5)