

PHYS 324 – Thermodynamics
Spring 2008

Homework 4: (due Feb 8th)

1. (a) Consider an adiabatically enclosed room of constant volume ($4 \times 6 \times 3 \text{ m}^3$) that contains an ideal diatomic gas ($\bar{C}_p = \frac{7}{2}R$) initially at 1 atm. Calculate the minimum amount of work that must be passed into the room to heat it from 10°C to 25°C .

(b) Consider a typical enclosed room in a house that is very well thermally insulated. Approximate the room to be an open system with negligible heat transfer. The room has constant volume ($4 \times 6 \times 3 \text{ m}^3$) and contains an ideal diatomic gas ($\bar{C}_p = \frac{7}{2}R$) initially at 1 atm. Calculate the minimum amount of work that must be passed into the room to heat it from 10°C to 25°C .
2. Air is compressed from an initial condition at 1 atm and 25°C to a final state of 5 atm and 25°C by two different mechanically reversible processes:
 - (a) Heating at constant volume followed by cooling at constant pressure.
 - (b) Isothermal Compression.

Consider that air behaves as an ideal gas with $\bar{C}_v = \frac{5}{2}R$ and $\bar{C}_p = \frac{7}{2}R$. Calculate the work, heat transferred and the changes in internal energy and enthalpy of the air for each process.

3. An electric current is passed through a resistance coil which is kept at constant temperature by being immersed in running water. Obtain an expression for the rate of creation of entropy in the system at the steady state. (You may need to consult your introductory physics text.) Show that the electrical conductivity of a substance is always expressed as a positive number.