2213 - Heat and E&M - 2009
Quiz - 09/16/09 Name: ________________________________ §#:

Show all work clearly and in order, and box your final answers. Simplify your expressions as best you can. Use the back of the sheet if you need to. You have 10 minutes to take this quiz. COMPARING THERMODYNAMIC PROCESSES. In a cylinder, n moles of an ideal *diatomic* gas, initially at pressure P_0 and temperature T_0, and volume V_0 is compressed until its volume halves. Consider three compression processes (a) isothermal, (b) adiabatic, (c) isobaric.
(*HINT: You don't actually have to compute anything to do this problem, although if you get stuck, the computations can't hurt.*).

1. (*4 points*) Show each process on the PV diagram below (label the curves (a), (b), and (c)):
We have for the end points (a) $(P_0, V_0/2)$ (b) $(2^\gamma P_0 \approx 2.6P_0, V_0/2)$ (c) $(2P_0, V_0/2)$

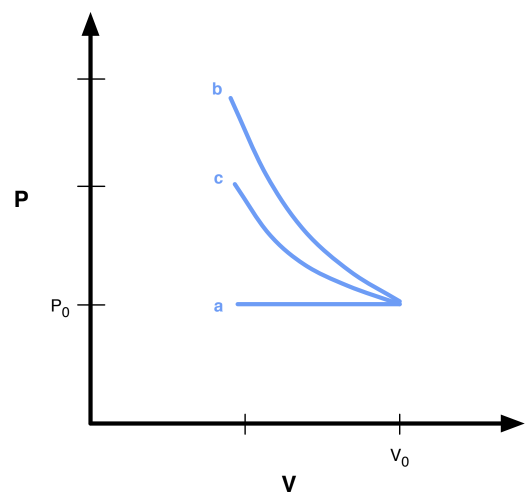

Figure 1: PV Diagram

2. (*2 points*) In which case is the absolute value of the work done on the gas greatest? Least?
The work is given by the area under the curve, we can see immediately that the adiabatic process involves the most work, and the isobaric process the least.

3. (*2 points*) In which case is the absolute value of the heat transfer greatest? Least?
Well, off the bat we know that there is no heat transfer for adiabatic processes, so the least heat transfer happens in the adiabatic process. As for which process has the greatest heat transfer, this one is a bit trickier, but you realize that it must be the isobaric process when you think about what isobaric compression is. Its putting the gas in contact with a cold bath for a while.

4. (*2 points*) In which case is the absolute value of the change in internal energy of the gas greatest? Least? We know that the change in internal energy is proportional to the change in temperature. Hotter temperatures are farther away from the origin. The Isothermal process marks a constant temperature process. So, immediately the change in internal energy is least for the isothermal process since its zero. It is greatest for the isobaric process, for which we have $T_f = 2T_0$ whereas the adiabatic process gives $T_f = 2^{(5/3-1)}T_0 < 2T_0$.