Homework 2

1. A typical human produces about 10 MJ of energy transferred as heat each day through metabolic activity.
   a) If a human body were an isolated system of mass 65 kg with the heat capacity of water ($C_{p,s}$ = 4.18 J g^{-1} K^{-1}), what temperature rise would the body experience?
   b) What is the mechanism of heat loss in our bodies since we are actually open systems?

2. During a thermodynamic process, a system moves from state A to state B, it is supplied with 400 J of heat and does 100 J of work.

   a) For this transition, what is the system's change in internal energy?
   b) If the system then moves from state B back to state A, what is its change in internal energy?
   c) If in moving from A to B along a different path, W'_{AB} = 400J of work is done on the system, how much heat does it absorb?

3. A sample containing 1.0 mol of perfect gas atoms ($C_{V,m}$= ½ R) initially at P1 = 100 atm and T1 = 300 K is heated reversibly to 400 K at constant volume. Calculate the final pressure, ΔU, q and W.

4. Answer the questions about the below pressure-volume diagram of a thermodynamic cycle.

   a) Write down the formulas to calculate the work done by each process.
   b) Determine when the work is done by the gas and when it is performed by the surroundings.
   c) Determine in which phases the gas absorbs heat from the surroundings and when it gives the heat off.