

Problem Set XI- Assign November 27, 2006 Due December 6, 2006.

Fall 2006 Physics 200a

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1. How much heat is needed to convert 1 *kg* of ice at -10°C to steam at 100°C ?. Remember ice and water do not have the same specific heat.
2. If 400*g* of ice at -2°C is placed in 1*kg* of water at 21°C what is the end product when equilibrium is reached?
3. To find c_X , the specific heat of material *X*, I place 75*g* of it in a 30*g* copper calorimeter that contains 65*g* of water, all initially at 20°C . When I add 100*g* of water at 80°C , the final temperature is 49°C . What is c_X ?
4. How many moles of ideal gas are there in a room of volume 50m^3 at atmospheric pressure and 300K ?
5. A spherical air bubble of radius 2*cm* is released 30*m* below the surface of a pond at 280K . What is its volume when it reaches the surface which is at 300K assuming it is in thermal equilibrium the whole time? Ignore the size of the bubble compared to other dimensions like 30*m*.
6. What is the volume of one mole of an ideal gas at STP: Standard Temperature (273K) and Pressure (1 atmosphere)?
7. One mole of ideal Nitrogen gas is at 2 atmospheres and occupies a volume of 10m^3 . Find T in Kelvins, U the internal energy (assumed to be just kinetic energy) in Joules, and the typical velocity of the gas molecules which have a mass $4.65 \cdot 10^{-26}\text{kg}$?
8. A copper rod of length 50 *cm* and radius 2 *cm* has one end dipped in an ice-water mixture and the other in boiling water. What is the heat flow dQ/dt ?
9. How much heat flows out per second through a concrete roof of area 100m^2 and thickness 20*cm* if the outside is at 0°C and the inside is at 17°C ?
10. A gas goes over the cycle ABCA as in Figure 1 where AC is an isotherm and AB is an isobar. (Note L stands for Liter, with $1\text{L} = 10^{-3}\text{m}^3$.) Find the (P, V) coordinates of C. What is the work done in each part of the cycle and the heat absorbed or rejected in the full cycle?
11. One mole of a gas with $\gamma = 4/3$ goes over the cycle ABCA as in Figure 2 where one of AB or AC is isothermal and the other adiabatic. (You figure out which.) Write down the (P, V, T) coordinates of A, B and C (some of which are already given). What is the work done in each part of the cycle and the heat absorbed or rejected in the full cycle?

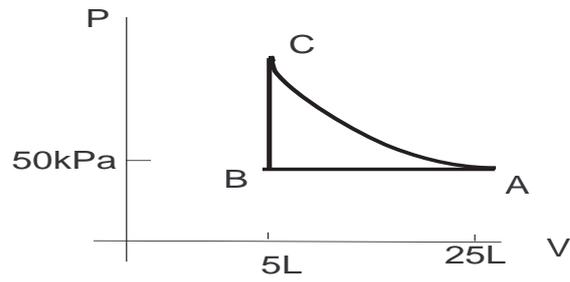


FIG. 1: The gas goes in a loop ABCA, where the section AC is isothermal.

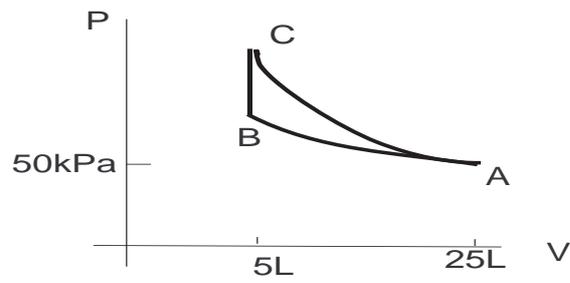


FIG. 2: The gas goes in a loop ABCA, where either AB or AC is isothermal and the other is adiabatic.