1. How much heat is needed to convert 1 kg of ice at $-10^0C$ to steam at $100^0C$?. Remember ice and water do not have the same specific heat.

2. If 400g of ice at $-2^0C$ is placed in 1kg of water at $21^0C$ what is the end product when equilibrium is reached?

3. To find $c_X$, the specific heat of material $X$, I place 75g of it in a 30g copper calorimeter that contains 65g of water, all initially at $20^0C$. When I add 100g of water at $80^0C$, the final temperature is $49^0C$. 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 $2cm$ is released $30m$ 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 $30m$.

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 $4.65 \cdot 10^{-26} kg$?

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 $100 m^2$ and thickness $20cm$ if the outside is at $0^0C$ and the inside is at $17^0C$?

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 $L = 10^{-3}m^3$.) 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.