

Recommended Problems for Week 2

1. Problem 1.28, page 20. (Here 600 W is the microwave power delivered by the microwave source, called a magnetron. The electrical power drawn from the wall outlet is typically about twice that, with the other half of the energy converted directly to thermal energy, mostly in the magnetron itself.)
2. A mole of air in a closed container is initially at 300 K. Suppose that you now add 1000 J of heat to the air, without doing any work on it. After you are finished, what is the total thermal energy of the air? What is its final temperature?
3. Problem 1.32, page 23.
4. Problem 1.33, page 23.
5. Use the Interactive Molecular Dynamics simulation to measure the heat capacity of the simulated system (at constant volume) in the gas phase. First make sure the system is behaving like a reasonably ideal gas, with plenty of space between the particles. When the temperature has stabilized, record it along with the total energy and the number of particles. Then add a small amount of energy to the system, let it equilibrate, and record the temperature and total energy again. Calculate the heat capacity from these data, and compare to the prediction of the equipartition theorem. Repeat the whole process with the system entirely in the solid phase (cold enough that there are no gas particles surrounding the solid crystal). You should find that the heat capacity in the solid phase is about twice what it is in the gas phase. Why is that?
6. Problem 1.36, page 26.
7. Problem 1.38, page 26.
8. Problem 1.42, page 31.
9. Problem 1.45, page 31.
10. Problem 1.48, page 33.
11. Problem 1.50, pages 35–36.