

## Recommended Problems for Week 7

1. Draw an energy flow diagram, similar to Figures 4.1 and 4.4, for an electric space heater. How would you define the efficiency of such a device, and what do the laws of thermodynamics tell you about the efficiency? Explain carefully.
2. Problem 4.6, pages 126–127. This is a long problem, but it's broken up into parts, and I think you'll be able to do it if you read it carefully, focus on one part at a time, and don't try to do it all in one sitting. The point it makes is extremely important: In order to run at a reasonable rate (produce a reasonable amount of *power*), a heat engine must create quite a bit of new entropy as a result of the heat flow processes. Therefore any practical engine will have an efficiency that's much lower than the Carnot limit.
3. Problem 4.8, page 129.
4. Problem 4.14, page 130. Heat pumps have been around for a long time, but they're a much bigger deal now than they were when your textbook was published.