4.8 EXERCISES

Entropy calculation

Ex 4.8.1. Evaluate the entropy change when a 5-kg block of copper is heated from 20°C to 70°C at the atmospheric pressure. Describe in words the thermodynamic process you have used for the calculation of the entropy change.

Ex 4.8.2. A system consisting of 20 moles of a monatomic ideal gas is cooled at a constant pressure from a volume of 50 L to 10 L. The initial temperature was 300 K. (a) What is the change in the entropy of the gas? (b) Show the thermodynamic process used for the calculation in a state diagram.

Ex 4.8.3. A glass beaker of mass 400 g contains 500 g of water at 27°C. The beaker is heated reversibly so that the temperature of the beaker and water rises gradually to 57°C. Find the change in entropy of the beaker and water together. Describe the thermodynamic process you have used for the calculation of the entropy change. Use c = 0.2 cal/g.K for glass.

Ex 4.8.4. A 100-g ice cube at −10°C is dropped into 500 g of liquid water at 60°C in a glass beaker in a thermally insulated environment. (a) Find the final state of the ice/water mixture. Calculate the change in the entropy from the initial state to the final state. (b) Describe in words the thermodynamic process you have used for the calculation of the entropy change.

Ex 4.8.5. Find the change in the entropy of 10 moles of a monatomic ideal gas whose state changes from (2 atm, 30 L) to (1 atm, 50 L) in an irreversible process. Describe in words the thermodynamic process you have used for the calculation of the entropy change and show the process in a state diagram.

Ex 4.8.6. A Carnot engine operates between 550°C and 20°C baths and produces 300 kJ of energy in each cycle. Find the change in entropy of (a) the hot bath, and (b) the cold bath, in each Carnot cycle?

Ex 4.8.7. Two moles of a monatomic ideal gas at (3 atm, 10 L) goes through a process that ends up with the state (6 atm, 20 L). Find the changes in (a) the internal energy of the gas and (b) the entropy.