Chapter 18 (Temperature, Heat, and the First Law of Thermodynamics)

1- In a constant-volume gas thermometer, the pressure is 0.019 atm at 100 degrees Celsius. Find the temperature when the pressure is 0.027 atm. (A: 257 degrees Celsius)

2- A 100 g of water at 100 degrees Celsius is added to a 20-g aluminum cup containing 50 g of water at 20 degrees Celsius. What is the equilibrium temperature of the system? The specific heat of aluminum is 900 J/(kg K) and the specific heat of water is 4186 J/(kg K). (A: 72 degrees Celsius)

3- A solid aluminum rod, of length 1.60 m and cross-sectional area of $3.14×10^{-4}$ m^2, has one end in boiling water and the other end in ice. How much ice melts in one minute? [The thermal conductivity of aluminum is 205 Watts/(m K) and the heat of fusion of water is $3.35×10^5$ J/kg] (neglect any heat loss, by the system, to the surrounding). (A: $7.2×10^{-4}$ kg)

4- An iron ball has a diameter of 6.0 cm and is 0.01 mm too large to pass through a hole in a brass ring when both are at a temperature of 30 degrees Celsius. To what temperature should the brass ring be heated so that the ball just passes through the hole? [The coefficient of volume expansion of iron = $3.6×10^{-5}$ K^{-1} and of brass = $5.7×10^{-5}$ K^{-1}] (A: 39 degrees Celsius)

5- The coefficient of linear expansion of gold is $14.20×10^{-6}$/K. If the density of gold is 19.30 g/cm^3 at 20 degrees Celsius, the density of gold at 90 degrees Celsius will be: (A: 19.24 g/cm^3)

6- By what factor does the rate of radiant emission of heat, from a heating element, increases when the temperature of a heating element increases from 27 degrees Celsius to 327 degrees Celsius? (A: 16)

7- A thermometer, of mass 0.06 kg and specific heat 836 J/(kg K), reads 15 degrees Celsius. It is then completely immersed in 0.15 kg of water of specific heat 4180 J/(kg K). The final temperature reading of the thermometer in the water is 45 degrees Celsius. Assuming no heat losses from the system to the surrounding, the initial temperature of the water was: (A: 47.4 degrees Celsius)

8- A closed cubical box (60 cm on edge and 5 cm on thickness) contains ice at zero degrees Celsius. When the outside temperature is 20 degrees Celsius, it is found that 250 grams of ice melt each hour. What is the value of the thermal conductivity of the walls of the box? (A: 0.03 Watts/m K)

9- A certain metal rod has a length of 10.00 m at 100.00 degree-C and a length of 10.04 m at 773 K. Find its length at zero degree-C. (A: 9.99 m)

10- In a P-V diagram, a system of an ideal gas goes through the process shown in figure. How much heat is absorbed after the system goes 100 times through the cycle? (A: 300 J)

11- Consider a copper slab of thickness L and area of 5.0 m^2. If the conduction rate through the copper slab is $1.2×10^6$ J/s and the temperature on the left of the slab is 102 degree-C while on the right of the slab it is -12.0 degree-C, what must be the thickness of the slab? [Take the coefficient of thermal conductivity of copper as 400 W/ m K)]. (A: 19 cm)