

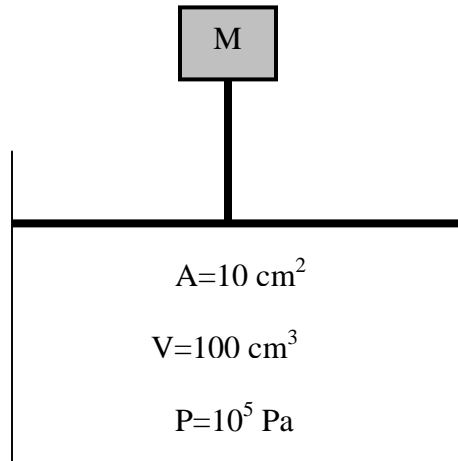
Physics 206b

Homework Assignment II
due August 31, 2007

As stated in class, the problems from Assignment #1 have been moved to the beginning of this assignment.

1. A pendulum is constructed out of a very thin rod of copper with a bob at the end with a mass of 2 kg. When the pendulum is initially built, its temperature is 290 K and it has a period of one second. If it is warmed up to a temperature of 310 K, what will its period be?
2. For the pendulum described in the previous problem, how many cycles will the pendulum go through in 24 hours at the higher temperature? If the pendulum is used as the heart of a clock, what time will the clock display after 24 hours at the higher temperature if it read 3:00 p.m. at the instant the temperature was increased?
3. A cube of aluminum that is 5 cm on each side is placed in 1 liter of water at 10° C in a graduated cylinder. The water is warmed up slowly, so that the aluminum remains in equilibrium with it, to a temperature of 90° C. What volume is indicated on the graduated cylinder at the higher temperature? (Ignore thermal expansion of the cylinder.)
4. At 24° C a steel nut is threaded onto a brass bolt. The bolt has a diameter of ¼ inch. The nut is slightly loose, with a diameter 10 microns larger than that of the bolt. Assuming the nut and bolt always have the same temperature as each other, at what temperature will the nut be tight?
5. How much energy is needed to raise the temperature of a piece of aluminum with a mass of 38 grams by 6 degrees C? (See the table in your textbook on page 373.)
6. A Snickers[®] bar contains 280 Calories (1 Calorie=1000 calories) of chemical potential energy. If such a bar is burned, converting all of its chemical potential energy to heat, by how much could it raise the temperature of a 500 gram sample of water?
7. A bartender wishes to cool down a shot of pure ethanol with a mass of 35 grams by adding a cold chunk of glass to it. (Again, see the table in your text.) If a 5 gram piece of glass is transferred from a bath of liquid nitrogen (T=77 K) into the ethanol (T=300 K), what will be the final temperature of the ethanol?

8. Consider again the candy bar in problem #6. If the energy is used to heat up a sample of ice at an initial temperature of -10°C , what is the maximum mass of ice that could be completely melted with the burning candy bar?
9. A bar of aluminum is used as a heating element. It is a cylinder with a diameter of 5 mm and a length of 7 cm. An electric current is run through it so that it heats up to a desired temperature. When it reaches its final temperature, it dissipates 1000 W. At what wavelength will the “glow” from this object peak?



10. Consider the sample of ideal, monatomic gas in a cylinder sealed by a piston shown above. Neglect any pressure of atmosphere outside of the cylinder. If the mass is $m = 10.2\text{ kg}$, how much heat must flow into the cylinder to raise the mass a distance of 2 cm? What will be the temperature of the gas when this is achieved?