

***Assignment #1***

Reading: Read Chapter 1 of Ristinen and Kraushaar (R+K) and Chapter 1 of Romer.

R+K Questions and Problems: Chapter 1, numbers 2, 3, 4, 5, 8

R+K Multiple Choice: Chapter 1, numbers 3, 4, 6, 7, 11, 12.

Romer: Problem 1.20

**At home experiment: *Estimating the energy required to heat your shower.***

Equipment: Graduated bucket and thermometer (pick up in class) and a watch, clock or stopwatch (you must provide). Before you begin your measurements, adjust the shower to the flow and temperature you usually use.

- Q1 – What is the flow rate of your shower in units of gallons/minute?
- Q2 – What is the temperature in degrees Fahrenheit of your shower water?
- Q3 – What is the temperature in degrees Fahrenheit of the cold tap water?
- Q4 – How many minutes do you run the water during a typical shower?
- Q5 – How many gallons of water do you use?
- Q6 – How many pounds of water do you use?
- Q7 – A BTU is defined to be the amount of energy required to heat one pound of water one degree Fahrenheit. How much energy (in BTU) was required to heat your shower water? How many Joules is this?
- Q8 – How much energy (in kW-hours) was used?
- Q9 – My electric company typically charges about fifteen cents per kW-Hr. Approximately how much would it cost to heat your shower with electricity?
- Q10 – You can generate about 100 Watts of mechanical power pedaling hard on a stationary bicycle. How long would you have to pedal to heat up your shower water?

Last year, Amherst College replaced all of the shower heads on campus with energy conserving shower heads. They reduced the flow to each shower head by about 1 gallon/minute. The cost of each of these shower heads was \$45.

Q11 – Estimate the number of showers that are taken at each shower head during a typical day.

Q12 – Assuming that the cost of the fuel used to heat the college's water is comparable to the cost of heating the water with electricity, estimate how long it will take for the savings on the college's fuel expenses to pay for the new shower heads.

You should turn in the results of your experiment and the answers to the assigned problems in class on Thursday, February 7.