

HIP 02

COMMENTS:

- Problem 1 is a list of suggested Student Workbook Volume 1 problems to practice in your spare time. You do not need to turn these in, they will not be graded. I recommend working through these before attempting problem 2, or if you get stuck while working on problem 2.
- Problem 2 will be graded based off of the HIP rubric.

(1) CH 11: 12, 13

CH 12: 9, 10, 25, 26, 28

(2) Beer brewing begins with steeping grains in hot water, releasing the sugars inside. The sugar water is then heated to a boil and hops added. The hot temperature of the boil extracts oil from the hops and provides sanitation from unwanted bacteria. The whole mess is cooled down and once it is safe enough for yeast to survive, they are added. The yeast convert the sugar to alcohol, and the oils from the hops provide many things including flavor and antibacterial benefits.

- a. If 16.5 lbs of grain at 67 °F are added to 5 gal of hot water and the equilibrium temperature of the mixture is to be 154 °F, what must the initial temperature (strike temperature) of the hot water be? The specific heat of malt grains is about 0.44 times that of water. Also assume no energy is lost during the time the system comes to equilibrium.
- b. During the one hour steeping stage, where the water and grain mixture started at 154 °F, the mixture only lost 2 F°. What was the average energy per time lost by the mixture.
- c. Enhancement: For this week's enhancement I will provide you with a question. You might wonder how much did it cost to heat the 5 gallons of tap water initially at 110 °F to the strike temperature? Assume the heating takes 47 minutes, electricity costs 15 ¢ per kilowatt-hour, and only 10% energy is lost during heating. HINTS: You might have to look up efficiency from chapter 11.1, also what are the units of kilowatt-hour?