

Homework 1  
due September 9, 2008

If you find yourself without enough information, make and justify a reasonable approximation. Please answer all parts of a question! (This is good practice for an exam setting.)

1. Send me an email message at `greenfield@egr.uri.edu` from each email address where you'd like to receive course-related e-mails. Make sure that your name is included in the e-mail note.  
Security info: (1) the address(es) will not be visible in the emails that I send, (2) your addresses will be added to an internal list of sophomore chemical engineers, unless you specifically opt out.

2. Carry out the following unit conversions:

- convert 1200 calories (cal) to J.
- convert 20 J/g to BTU/lbm

Any unit conversion method is okay, as long as you clearly show what you're doing.

3. A bioreactor contains *E. coli* bacteria that have the capability (via recombinant DNA) to produce human insulin. In order to recover the insulin, the cells are suspended in water and are then extracted using a centrifuge.

The initial suspension of cells in water has a density of 64 lbm/ft<sup>3</sup>. The centrifuge has 8 compartments, each of which can hold a volume of 0.5 L. How many **kilograms** of this suspension can be processed in one centrifuge batch?

4. Felder and Rousseau, problem 2.7

5. You may have learned in freshman labs about the uses of *mean* and *standard deviation* for interpreting measurements. Review (or learn) these concepts from chapter 2, pp 16-19.

**Then do** Felder and Rousseau, problem 2.18.

6. On a tour at Witherspoon's Candy Company, you are shown a process for manufacturing 100.0 kg/h of candy. The candy is made by mixing two "feed" streams. One feed stream contains chocolate, with 0.28 mass fraction fat. The other feed stream contains peanut butter and has a flow rate of 18.0 kg/h. Each piece of finished candy contains 0.31 mass fraction fat and 0.69 mass fraction non-fats.

- From this description, what would you describe as "in"s and what as "out"s?
- Draw a flowsheet (i.e. a picture) of this process. Label each part as specifically as you can.

*Don't worry yet* about doing calculations. Those will arise soon enough!