Name: _____

Exam 3 v.1.0
BE-381, Fall '08, Dr. C. S. Tritt

This is a 1 hour closed book, closed notes exam. Write your
answers on the paper provide and organize and explain you work
for full and partial credit. You may use 1 double sided, 8½ by
11 inch equation sheet, EES and the provided Units Conversion
Factors and Properties handout. If you use EES, e-mail me your
files (the file names should encode your last name and the problem
number) at the end of the exam and clearly indicate on your exam
that you used EES. Please turn in your units conversion handout at
the en d of the test. Put your name on it if you make any marks or
notes in it. There are 4 problems, point values are as indicated.
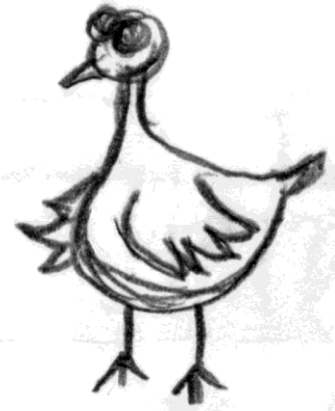
R. Vanselow '04

Figure 1: Pointless chicken.

1. (20) A medical device for blood analysis requires refrigeration.
   Specifically, 60 kJ/min of heat must be removed from a
   compartment at 4.0°C and exhausted to the surroundings at 24°C. What is the absolute,
   theoretical minimum power input required to perform this refrigeration and corresponding
   minimum rate of heat transfer (in Watts) to the surroundings?

2. (30) Water vapor at a flow rate of 0.500 kg/s enters an adiabatic, reversible (i.e., isentropic)
   compressor at 50.0 kPa and 150°C and leaves at 400 kPa. Find its outlet temperature and the
   minimum power requirement for the compressor.

3. (20) Modern operating room standards call for a temperature of 65°F and relative humidity of
   40%. Find the following (in English or SI units) for moist air under these conditions: absolute
   humidity, dew point temperature, dew point pressure, wet bulb temperature and specific
   volume.

4. (30) An air-conditioning system in a hospital is to take in 15 m^3/s of air at 1 atm, 35°C, and 70%
   relative humidity and deliver it at 15°C and 40% relative humidity. The air first flows over
   cooling coils, where it is cooled and dehumidified, and then over steam heated pipes, where it
   is reheated to the desired temperature. Determine 1) the temperature of air before it enters the
   heating section, 2) the amount of water removed as condensate in kg H_2O/s and 3) the amount
   of heat (in kJ/s) transferred in the heating section.

Property pages needed: 998, psychrometric chart