≥70 okay

Key - Ave 63
High 87
Low 45
Std. dev. 14

Name: _____

Exam 1 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 end of the test. Put your name on it if you make any marks or notes in it. There are 5 problems, point values are as indicated.

1. (15) A typical systolic blood pressure is equivalent to a 120 mm column of mercury in a location where the gravitational acceleration is 9.81 m/s^2 (typically written 120 mm Hg). What is this pressure expressed in kPa and inches of water? In your calculations you may assume the density of mercury is 13,534 kg/m^3 and that of water is 1,000 kg/m^3, if necessary.

2. (15) In a particular instance, blood is pumped by the heart at a rate of 5.00 kg/minute and with an average pressure change across the heart of 12.0 kPa. Assume the blood has a density of 1,025 kg/m^3. Neglecting changes in potential and kinetic energy, at what rate is mechanical work being done on the blood by the heart? Express your answer in horse power (hp).

3. (16) Calculate the amount of cooling (in Watts) required to maintain an operating room at constant temperature during an operation. Assume the medical staff consists of 4 people; each generating 450 kJ/hr of thermal energy. Assume the patient generates thermal energy at a rate of 250 kJ/hr. Assume the surgical light consumes 400 W and medical equipment in the room consumes 750 W of electrical power. Neglect heat loss from the room.

4. (24) Complete the following table of properties for R-134a.

T (°C)	P (kPa)	v (m^3/kg)	Phase description or quality (x)
-8.0	320	0.0007572	Subcooled liquid use $v^{sat}(T)$
37.31	800	0.0150	liq.-vap mix, x = 0.573
-10.09	200	0.099867	Saturated vapor
80	400	0.068747	Superheated vapor

5. (30) A rigid tank contains 0.500 kg of water at an initial temperature of 50°C and a quality, *x*, of 0.250. What is the initial pressure in the tank and its volume? Heat is added to the tank until the pressure in the tank reaches 100 kPa. Estimate the final temperature of the water and how much heat was added to it.