Name:_____ **Thermo no.**_____

ME 200

Summer 2011

Exam 2

Friday 15 July

READ THESE INSTRUCTIONS

1. This is a closed book examination. All needed property tables, equation sheets and units conversions are provided as attachments to this exam.
2. Do not hesitate to ask questions if you do not understand a problem statement.
3. Start each problem on the same page as the problem statement. Write on only one side (the front) of each page. Material on the back side of any page **will not** be graded. Additional paper will be provided upon request.
4. Put only one problem on each page. A second problem on the same page **will not** be graded.
5. Follow the Problem Solution Format given in class in order to be eligible for full credit.
6. If you provide multiple solutions, you will receive only partial credit even if one of the solutions is correct. Delete the solution(s) you do not want.
7. For your own benefit, please write clearly and legibly.
8. After you have completed the exam, **at your seat**, put your papers in order. This may mean that you have to remove the staple and then re-staple at the front of the room. Regardless, **do not turn in loose pages**.
9. Once time is called you must stop writing **immediately**. Points will be subtracted from those writing after this time (**not kidding** on this one—it's a pet peeve of mine).

Problem	Possible score	Your score
1	59	
2	41	
Total	**100**	

[59 points] Turbojet engines are used to propel some aircraft. They consist, in part of a, diffuser which decelerates the air flow entering the engine to essentially zero speed while raising its pressure, followed by a compressor which further increases the air pressure. The following information is given:

Air enters the diffuser at a speed of 604 mph (270 m/s), a temperature of -40 F (also -40 C) and a pressure of 4.35 psia (30 kPa). The air undergoes an isentropic process until its velocity drops to essentially 0 m/s. **Find the diffuser exit temperature, assuming that the air specific heats are constant (c_p = 1.00 kJ/kg-K, c_v = 0.717 kJ/kg-K).** Report your answer in C. **Then find the diffuser exit pressure.** Report your answer in bar.

The air now passes through the (non-ideal) compressor. It has an exit pressure of 10 bar and temperature of 350 C. The compressor consumes 400 kJ/kg of work. **Find the heat transfer for this process.** Report your answer in kJ/kg.

[The molecular weight, or molar mass, of air is 28.9 kJ/kmole.]

[41 points] In the movie "Harry Potter and the Goblet of Fire" Harry must jump into the lake and rescue Ron Weasley. It's clear from the movie that the lake is quite cold as all the contestants (Harry, Cedric Diggory, Viktor Crum and Fleur Delacroix) are wrapped in towels when the event is over.

Assume Harry's mass is 55 kg, and that his specific heat is 3.5 kJ/kg-K. Also assume that Harry enters the lake with a body temperature of 37 C, and that his body temperature has fallen to 35 C when he exits. **Compute the Harry's entropy generation for the process, assuming that the lake only has energy interactions with Harry.** Report your answer in kJ/K. **Then compute the entropy change for the lake, and its entropy generation.** Report your answers in kJ/K. Note that the lake is quite large so it can be modeled as a thermal reservoir. Its temperature is 10 C.