Name:____________________________ Instructor:____________ Section:__________ ENGR 222 - Quiz 6

Allowed Materials: *pencils and/or pens.*

ExamForm := 65

Honor Statement: *On my honor, I promise that I have not received any unauthorized assistance on this exam (I didn't look at another student's paper, I didn't view any unauthorized written materials, I didn't talk or listen to another student, I didn't use an unauthorized calculator, I didn't use any electronic device, any visual or auditory signals, or any other techniques of exchanging information with others.) I have maintained the highest standards of academic integrity while completing this exam.*

*Signed:*____

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1. *(2 point deduction for failure to complete this problem!)*

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Bubble:	For Course Section:
01	001 Hollins
02	002 Reeves
03	003 Reis

- Write in all of the indicated information in the boxes of your response form.
- Darken the appropriate circles to encode the corresponding information.
- Write your name on this exam and sign the Honor Statement.

Notes:

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- **"F.I."** and **"M.I."** are your first and middle initials, respectively
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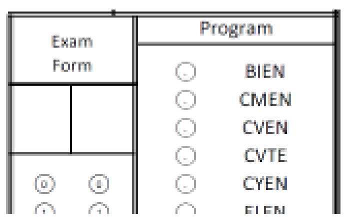

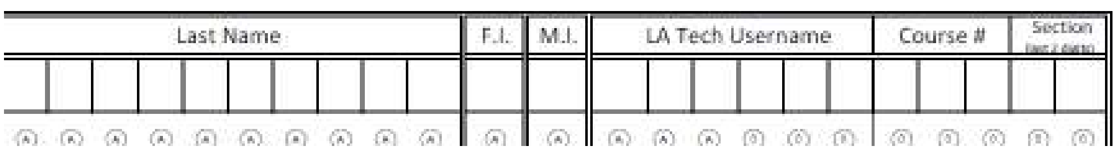

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"I properly completed all required items in problem 1, so I will not lose these points"} \\ \text{"B"} & \text{"I did not properly complete problem 1 because I am fine with losing these points."} \end{pmatrix}$$

Please put your final answers on the answer sheet that was given to you. You must show your work to receive full credit.

The words "steam" and "water" may be used interchangably. Check the tables to determine the phase of the system.

Unless the problem states otherwise, assume that the atmospheric pressure is 101.325 kPa or 14.7 psia.

Read the questions carefully and CHECK YOUR UNITS.

You may write on the exam. There is additional space on the back if you need it.

If you made any marks in your steam table, please erase them before turning in your packet.

Good luck!

2. (10 points) For a process to be considered isentropic, which criteria must be met: (Bubble in ALL answers that are correct.)

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"isenthalpic"} \\ \text{"B"} & \text{"isometric"} \\ \text{"C"} & \text{"adiabatic"} \\ \text{"D"} & \text{"isothermal"} \\ \text{"E"} & \text{"reversible"} \\ \text{"F"} & \text{"single phase"} \\ \text{"G"} & \text{"isobaric"} \end{pmatrix}$$

3. (10 points) The equality part (i.e. = 0) of the Clasius inequality holds true for:

$$\oint \frac{\delta Q}{T} \leq 0$$

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"isobaric cycles"} \\ \text{"B"} & \text{"irreversible cycles"} \\ \text{"C"} & \text{"all cycles"} \\ \text{"D"} & \text{"reversible cycles"} \\ \text{"E"} & \text{"isometric cycles"} \\ \text{"F"} & \text{"adiabatic cycles"} \end{pmatrix}$$

4. (10 points) For the following relations to be used, what conditions must be satisified? (Bubble in ALL answers that are correct.)

$$\left(\frac{T_2}{T_1}\right) = \left(\frac{P_2}{P_1}\right)^{\left(\frac{k-1}{k}\right)} = \left(\frac{v_1}{v_2}\right)^{(k-1)}$$

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"isothermal"} \\ \text{"B"} & \text{"incompressible"} \\ \text{"C"} & \text{"ideal gas"} \\ \text{"D"} & \text{"isobaric"} \\ \text{"E"} & \text{"constant specific heat"} \\ \text{"F"} & \text{"isometric"} \\ \text{"G"} & \text{"isentropic"} \end{pmatrix}$$

5. (10 points) A piston cylinder contains $\text{mass} = 8.8 \cdot \text{kg}$ of saturated liquid R-134a at 200 kPa. The refrigerant is heated until it reaches a new temperature $\text{of} = 10 \cdot °\text{C}$. The change of entropy of the ***system*** is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 7.07 \\ \text{"B"} & 7.44 \\ \text{"C"} & 7.82 \\ \text{"D"} & 8.20 \\ \text{"E"} & 8.58 \\ \text{"F"} & 8.95 \\ \text{"G"} & 9.34 \\ \text{"H"} & 9.71 \end{pmatrix} \cdot \frac{\text{kJ}}{\text{K}}$$

6. (10 points) A block $\text{of} = \text{"iron"}$ with a $\text{mass} = 130\cdot\text{lbm}$ and initial temperature of 200ºF is dropped into a large lake with a $\text{temperature} = 59\cdot°\text{F}$. The entropy generated for this process after thermal equilibrium is reached is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 0.3923 \\ \text{"B"} & 0.4143 \\ \text{"C"} & 0.4365 \\ \text{"D"} & 0.4586 \\ \text{"E"} & 0.4806 \\ \text{"F"} & 0.5028 \\ \text{"G"} & 0.5251 \\ \text{"H"} & 0.5470 \end{pmatrix} \cdot \frac{\text{Btu}}{\text{R}}$$

7. (10 points) Air is compressed adiabatically from 20 ºC and 100 kPa $\text{to} = 220\cdot°\text{C and} = 580\cdot\text{kPa}$ at a rate of 0.6 kg/s. Assuming that the specific heat of air is constant (at a value taken from 300 K), the rate of generation of entropy for this **process** is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 0.0083 \\ \text{"B"} & 0.0089 \\ \text{"C"} & 0.0096 \\ \text{"D"} & 0.0103 \\ \text{"E"} & 0.0109 \\ \text{"F"} & 0.0116 \\ \text{"G"} & 0.0123 \\ \text{"H"} & 0.0129 \end{pmatrix} \cdot \frac{\text{kW}}{\text{K}}$$

8. (10 points) Air enters an adiabatic compessor of a (real) heat engine at 285 K and 110 kPa and leaves at $= 550 \cdot \mathrm{K}$ and $= 690 \cdot \mathrm{kPa}$. The specific generation of entropy of the air for this **process** is closest to:
(Hint: do not assume constant specific heat.)

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 0.09072 \\ \text{"B"} & 0.10070 \\ \text{"C"} & 0.11079 \\ \text{"D"} & 0.12061 \\ \text{"E"} & 0.13061 \\ \text{"F"} & 0.14055 \\ \text{"G"} & 0.15050 \\ \text{"H"} & 0.16041 \end{pmatrix} \cdot \frac{\mathrm{kJ}}{\mathrm{kg} \cdot \mathrm{K}}$$

9. (10 points) Helium is isentropically compressed from 14 psia and $= 59 \cdot °F$ to a pressure $= 91 \cdot psia$.
The temperature of the helium after the compression process is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 558.5 \\ \text{"B"} & 578.5 \\ \text{"C"} & 597.8 \\ \text{"D"} & 617.6 \\ \text{"E"} & 637.2 \\ \text{"F"} & 656.9 \\ \text{"G"} & 676.6 \\ \text{"H"} & 696.1 \end{pmatrix} \cdot °F$$

10. (10 points) A heat engine with an efficiency $= 62 \cdot \%$ generates 500 kW of power. The engine absorbs heat from a furnace maintained at $= 730 \cdot °C$ and rejects heat into a nearby lake with an average temperature of 23 ºC. The rate of entropy generation for this **cycle** is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 0.149 \\ \text{"B"} & 0.165 \\ \text{"C"} & 0.182 \\ \text{"D"} & 0.198 \\ \text{"E"} & 0.215 \\ \text{"F"} & 0.231 \\ \text{"G"} & 0.247 \\ \text{"H"} & 0.264 \end{pmatrix} \cdot \frac{kW}{K}$$

A piston cylinder contains 5 kg of steam initially at 200 kPa and $= 150 \cdot °C$. The cylinder exchanges heat with the surrounding room which has an average temperature of 28 ºC until half of the steam condenses.

11. (2 points) The amount of heat exchanged is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 5.463 \times 10^3 \\ \text{"B"} & 5.818 \times 10^3 \\ \text{"C"} & 6.171 \times 10^3 \\ \text{"D"} & 6.527 \times 10^3 \\ \text{"E"} & 6.879 \times 10^3 \\ \text{"F"} & 7.231 \times 10^3 \\ \text{"G"} & 7.583 \times 10^3 \\ \text{"H"} & 7.935 \times 10^3 \end{pmatrix} \cdot \text{kJ}$$

12. (8 points) The amount of entropy that is generated for the **process** is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 4.280 \\ \text{"B"} & 4.557 \\ \text{"C"} & 4.834 \\ \text{"D"} & 5.112 \\ \text{"E"} & 5.390 \\ \text{"F"} & 5.668 \\ \text{"G"} & 5.936 \\ \text{"H"} & 6.217 \end{pmatrix} \cdot \frac{\text{kJ}}{\text{K}}$$

END OF EXAM

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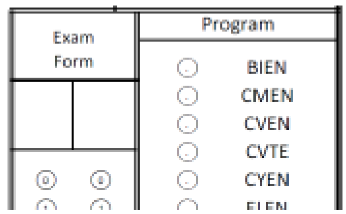

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Read the questions carefully and CHECK YOUR UNITS.

If a question does not contain enough information to solve, please select the appropriate answer "not enough information".

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Good luck!

ExamForm = 65

Key =

	1
1	"A"
2	"CE"
3	"D"
4	"CEG"
5	"B"
6	"C"
7	"E"
8	"F"
9	"E"
10	"F"
11	"B"
12	"B"
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