ME 200 – Thermodynamics, L. Liebenberg

**Name:** Joseph Specht

**Quiz 10** (Total: 30 points; 5 bonus points possible) **Due back on Wed. 19 April, 10 p.m.**

* *Save your entire assignment as one PDF document and upload it in the appropriate assignment folder on Canvas.*
* *Assignments will only be graded if the honor code statement, below, is completed and signed.*

**Honor Code Statement**

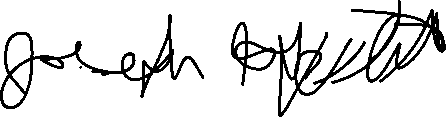
***ME 200, Quiz 10***

Being a student of high standards, I pledge to embody   
the principles of *academic integrity*.

This ME 200 quiz is my own work. I did not seek (or get) outside help or collaboration with any of the questions and their solutions. I also did not offer my solutions to any other student.

I understand that this quiz is “open book” and “open notes” which means that I was permitted to use my prescribed textbook and lecture notes when addressing any of the questions. I have properly cited any other resources, with full cognizance of the regulations pertaining to plagiarism, copyright infringement, academic cheating, etc., as stipulated in the Student Code.

I acknowledge that academic violations will be dealt with according to the UIUC Student Code,   
Article 1, Part 4.



ME 200 Student’s signature:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Student’s Name: Joseph Specht

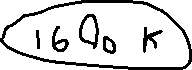
Net-ID: jspecht3

Date: 4/17/23

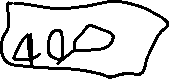
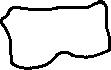
1. A reversible power cycle receives energy *Q*H by heat transfer from a hot reservoir at *T*H and rejects energy *Q*C by heat transfer to a cold reservoir at *T*C.
   1. If *T*H = 1600 K and *T*C = 400 K, what is the thermal efficiency of the engine? (Remember to also draw a schematic diagram illustrating the source and sink and the engine receiving/emitting heat and doing work.) *(5 points)*



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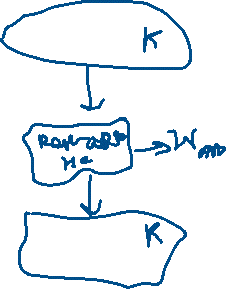


* 1. If *T*H = 500ºC and *T*C = 20 ºC, and *W*cycle = 1000 kJ, what are *Q*H and *Q*C? *(5 points)*

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*jnk*

1. The data listed below are claimed for power cycles operating between hot and cold reservoirs at   
   1000 K and 400 K, respectively. For each case, determine whether such a cycle satisfies the first and the second laws of thermodynamics. (For the Second-Law efficiency, your merely need to compare the efficiency of a reversible cycle with that of an irreversible cycle and draw conclusions from that.) Then, also state if the cycle is possible in the real world or not. Remember to draw a schematic diagram showing heat source, heat sink, engine, heat flows, and work transfer.)
   1. *Q*H = 300 kJ, *W*cycle = 160 kJ, *Q*C = 140 kJ *(5 points)*

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* 1. *Q*H = 300 kJ, *W*cycle = 180 kJ, *Q*C = 120 kJ *(5 points)*

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* 1. *Q*H = 300 kJ, *W*cycle = 170 kJ, *Q*C = 140 kJ *(5 points)*

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* 1. *Q*H = 300 kJ, *W*cycle = 200 kJ, *Q*C = 100 kJ *(5 points)*

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1. **Optional question for bonus credit (5 bonus points possible)**

A thermodynamic system executes a power cycle while receiving 1050 kJ by heat transfer at a temperature of 525 K and discharging 700 kJ by heat transfer at 350 K. There are no other heat transfers. Show all your calculations and explain your assumptions as well as your answer/s. (As always, you also need to draw a representative diagram of the set-up.)

Using the Clausius inequality (eq. 5. 13 in your textbook), determine whether the cycle is internally reversible, irreversible, or impossible. *(5 points)*

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