MET 350

Test 2 – Test Reflection

Caitlyn Six

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Test 2: Google Drive Link to Test 2

In this test reflection, I will thoroughly analyze my performance on Test 2. I will compare my answers to both questions to the posted solutions and pinpoint where my mistakes were and how I could avoid them in the future. I will assess my test using the provided grading rubrics and points system and “grade” my own work with objectivity. Then I will reflect on what I learned by taking this test and how I can apply the principles in my daily life and future career.

On Problem 1, I followed a similar procedure as the one presented in the posted solution and got similar answers while setting my states; the only difference was my h6 value. I did not realize h6 would have the same enthalpy as h5 and used the saturated liquid enthalpy value for a pressure of 5000 kPa. This led to an inaccurate calculation of Q_{in} much later on. I got the same answer for mass fraction “y;” however, I did not get the same answer for mass fraction “z.” The reason why I got a different answer for “z” was because I didn’t do simple algebra on the mass fraction equation to solve for “z,” rather, I followed an example from the textbook. The textbook example had analyzed a closed feedwater as well, so I’m unsure why the method was inaccurate. While solving for “z,” I used (h3-h2) in the numerator and ((h10-h14)+(h3-h2)) in the denominator when I should have only had (h10-h14) in the denominator. This error resulted in a “z” value of 0.154 instead of 0.1813.

After this error, all remaining calculations involving “z” were incorrect, though the method of solution was fairly accurate. During the calculation of the turbine work output, I made a mistake regarding how the mass fractions applied to the turbine states. This mistake in conjunction with the incorrect “z” value led to an inaccurate turbine work output value. I also misinterpreted the problem statement; I thought I was looking for the rate forms of work and heat, and therefore, multiplied every answer I got by mass flow rate. As a result of the previously mentioned mistakes, my thermal efficiency for the system ended up being higher than the thermal efficiency in the posted solution.

Though my results were not perfect, I do feel that I demonstrated a reasonable understanding of how to analyze an ideal Rankine cycle and apply the concepts of re-heating and regeneration to a steam power plant, satisfying the 5^{th} bulleted Course Objective in section 4.1 of the syllabus. If I were to do the problem again, I would use algebra to solve for “z” rather than blindly following a textbook example, which would lead to more accurate results. I would also double-check how the mass fractions applied to the various states. If I had analyzed the path of mass flow rate through the system more carefully and revised my T-s diagram as I solved the problem, perhaps I would have been more successful when calculating the turbine work output.

My work on Problem 2 was very similar to my work on Problem 1 in terms of method of solution. As a result, I feel that my efforts in Problem 2 satisfy the same course objective as Problem 1, which states “Apply Rankine Cycle with superheating, re-heating, and regeneration to steam power plants.” I correctly calculated h3 for Problem 2, recognizing that it would be different than the h3 for Problem 1. I did not use the correct h6 for Problem 2, instead, I used the same value that I used in Problem 1, resulting in an incorrect value for Q_{in} once again. I did correctly calculate mass fraction “y,” though the formatting of my equation when solving for ΔT

in part B resulted in an incorrect answer. Similarly to my work on Problem 1, I made a mistake when determining how the mass fraction “y” applied to the turbine work output states. I also multiplied every answer I got by mass fraction to get the rate form of the answer, just like I did in Problem 1. All answers in part C of problem 2 were incorrect; however, I feel that I demonstrated some level of competency regarding method of solution.

If I were given the chance to do this problem again, I would question which states differed from Problem 1 more carefully. Though working through the states starting from state 1 and setting each one again seemed like a waste of time, perhaps if I had, I would have realized that h6 was equal to h5. Doing so may have helped me get more accurate results for this problem and Problem 1. Just like Problem 1, I would double-check how the mass fractions applied to the various states. If I had analyzed the path of mass flow rate through the system more carefully and revised my T-s diagram as I solved the problem, my work turbine output calculation may have been more accurate.

Following the writing rubric, I feel my analysis section for both problems may be lacking since I didn’t discuss all results like the summaries in the posted solution; I only discussed the mass fractions and provided tabulated results for the rest. I believe 7/10 (unweighted) points for the summary would be a fair assessment. Using the writing rubric and the posted solution as a guide, I believe I earned 10/10 (unweighted) points for all other writing rubric categories. Using the rubric for Problem 1, I think I earned full marks on steps 1, 2, and 4. Due to my incorrect calculation of h6, I believe step 3 earned 1.7/10 points. Steps 5 and 6 earned 0.7/10 each, step 7 earned 1.5/10, and step 8 earned 0.5/10. Using the rubric for Problem 2, steps 1, 2 and 4 earned full marks. Step 3 earned 1.7/9 points for the same reason as Problem 1. Step 5 earned 0.7/9, step 6 earned 1.5/9, and step 7 earned 0.5/9. In conclusion, I earned 9.035/10 points for the writing rubric, 8.1/10 points for Problem 1, and 7.4/9 points for Problem 2, totaling 74.324 points using the grading formula. Adding an assumed 10/10 for the completed homework results in a final grade of 84.324 points for Test 2. The marked-up rubrics that support this grade are at the end of this document.

I estimate that I spent approximately 14 hours working on this test over 4 days; though the first 6 hours were spent in frustration and did not yield any real progress. A major problem I had working on this test was realizing that I did not need to set all states presented in the problem diagram. At the beginning of the exam period, I was convinced that I had to set all states in order to complete the problem; though problems 1 and 2 didn't ask me to compare the efficiency of the system when fully operational to the efficiencies when the stated components weren't working, I thought that I needed to. My initial interpretation of the problem, essentially, had me backed into a corner without a way to get myself out. It wasn't until I received counsel from Professor Ayala that I realized I had added an unnecessary step to the test. Professor Ayala helped guide me through the requirements for Problem 1 with understanding and patience, which I am grateful for. In the future, I will not hesitate to ask for clarification regarding what I am being asked to do; if I had not asked for help with this test, I am confident I would have been unable to complete this test at all.

As an aspiring engineer, I know that increasing my awareness and understanding of all major energy systems will be invaluable in my career. The study of thermodynamics and the applications it is used in may be of special interest to me if I go into the nuclear industry. I firmly believe that nuclear energy is one of the best alternative energy sources currently in existence. However, without having a strong foundational knowledge of existing energy generation methods, like traditional steam power plants, I won't be able to help create nuclear systems that are safer and more efficient than those traditional energy sources. I do not use the Rankine cycle in my daily life and my current job does not serve an industry where producing energy in an efficient way is a concern; however, given my aspirations for the future, the concepts covered in Chapter 10 were very important to me. I believe being able to draw a parallel between those concepts and the industry I hope to contribute to in the future increased my depth of understanding. In conclusion, though I made some foolish or simple mistakes on this test, I do feel that I demonstrated adequate understanding of the chapter concepts and am looking forward to applying the lessons learned in my career and daily life whenever the opportunity arises.

Grading Rubrics:

WRITING RUBRIC (Applied to the whole test, not to particular problems)

1. Purpose	0.5/10.0 out of 0.5/10.0
2. Drawings	1.0/10.0 out of 1.0/10.0
3. Sources	1.0/10.0 out of 1.0/10.0
4. Design considerations	1.0/10.0 out of 1.0/10.0
5. Data and variables	0.5/10.0 out of 0.5/10.0
6. Procedure	2.0/10.0 out of 2.0/10.0
7. Calculations	2.0/10.0 out of 2.0/10.0
8. Summary	**0.035/10.0** out of 0.5/10.0
9. Materials	0.5/10.0 out of 0.5/10.0
10. Analysis	1.0/10.0 out of 1.0/10.0
TOTAL	9.035/10.0 **out of 10.0/10.0**

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Problem solution rubric

	Exceeds Standard 4 10 points	Meets Standard 3 7 points	Approaches Standard 2 4 points	Needs Attention 1 0 points
1. Purpose 5%	The purpose of the section to be answered is clearly identified and stated.	The purpose of the section to be answered is identified, but is stated in a somewhat unclear manner.	The purpose of the section to be answered is partially identified, and is stated in a somewhat unclear manner.	The purpose of the section to be answered is erroneous or irrelevant.
2. Drawings & Diagrams 10%	Clear and accurate diagrams are included and make the section easier to understand. Diagrams are labeled neatly and accurately.	Diagrams are included and are labeled neatly and accurately.	Diagrams are included and are labeled.	Needed diagrams are missing OR are missing important labels.
3. Sources 5%	Several reputable background sources were used and cited correctly.	A few reputable background sources are used and cited correctly.	A few background sources are used and cited correctly, but some are not reputable sources.	Background sources are cited incorrectly.
4. Design considerations (assumptions, safety, cost, etc) 10%	Design is carried out with applicable assumptions and full attention to safety and cost, etc.	Design is generally carried out with assumptions and attention to safety, cost, etc.	Design is carried out with some assumptions and some attention to safety, cost, etc.	Assumptions, safety and cost were ignored in the design.
5. Data and variables 5%	All data and variables are clearly described with all relevant details.	All data and variables are clearly described with most relevant details.	Most data and variables are clearly described with most relevant details.	Data and variables are not described OR the majority lack sufficient detail.
6. Procedure 25%	Procedure is described in clear steps. The step description is in a complete and easy to understand short paragraph.	Procedure is described in clear steps but the step description is not in a complete short paragraph.	Procedure is described in clear steps. The step description is in a complete short paragraph but it is difficult to understand.	Procedure is not described in clear steps at all.
7. Calculations 20%	All calculations are shown and the results are correct and labeled appropriately. The units of all values are shown.	Some calculations are shown and the results are correct and labeled appropriately.	Some calculations are shown and the results labeled appropriately.	No calculations are shown OR results are inaccurate or mislabeled.
8. Summary 5%	Summary describes the design, the relevant information and some future implications.	Summary describes the design and some relevant information.	Summary describes the design.	No summary is written.
9. Materials 5%	All materials used in the design are clearly and accurately described.	Almost all materials used in the design are clearly and accurately described.	Most of the materials used in the design are clearly and accurately described.	Many materials are described inaccurately OR are not described at all.
10. Analysis 10%	The design is discussed and analyzed. Argumentative predictions are made about what might happen in case of change in the operation and how the design could be change.	The design is discussed and analyzed. Argumentative predictions are made about what might happen in case of change in the operation.	The design is discussed and analyzed. No argumentative predictions are made about what might happen in case of change in the operation and how the design could be change.	The design is not discussed and analyzed.

Total points = 9.035/10

PROBLEM 1)

1. P-v and T-s diagrams 1/10 out of 1/10
2. Realize that some states are not needed 1/10 out of 1/10
3. State calculations (at least 11 of them) 1.7/10 out of 2/10
4. Calculate “y” and get y=0 1/10 out of 1/10
5. Calculate “z” 0.7/10 out of 1/10
6. Calculate deltaT water 0.7/10 out of 1/10
7. Thermal efficiency (Wnet & Qin) 1.5/10 out of 2/10
8. Final results 0.5/10 out of 1/10

TOTAL 8.1/10 **out of 10/10**

PROBLEM 2)

1. P-v and T-s diagrams 1/9 out of 1/9
2. Realize that some states are not needed 1/9 out of 1/9
3. State calculations (at least 8 of them) 1.7/9 out of 2/9
4. Calculate “y” 1/9 out of 1/9
5. Calculate deltaT water 0.7/9 out of 1/9
6. Thermal efficiency (Wnet & Qin) 1.5/9 out of 2/9
7. Final results 0.5/9 out of 1/9

TOTAL 7.4/9 **out of 9/9**

Final Grade (Actual) = 9.035 + 40*(8.1/10+7.4/9) = 74.324 + 10 HW points = 84.324