MET 350

Test 1 – Test Reflection

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Test 1: Google Drive Link to Test 1

In this test reflection, I will thoroughly analyze my performance on Test 1. 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 rubric 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. I did not get the same answers; however, most of my answers were similar enough for me to feel confident that I understood the thermodynamic concepts used in analyzing gas turbine engines, the type of modification used on the test, and how to apply the first law of Thermodynamics to the problem. The answer that deviated most significantly from the posted solution was the heat exchanger effectiveness from part A; I got an effectiveness of 0.38, while the posted solution was 0.86.

The reason why this answer was so different was because I used an incorrect variation of the effectiveness formula and took data from different states than I should have. I struggled with developing my P$\cancel{V}$ and T-s diagrams for this problem; I was reasonably sure that it was a regenerative cycle and tried to model that when setting my states, but I did not include a 6^{th} state.

I believe that error led to some calculation mistakes when fixing my states and when selecting equations to satisfy the requirements of the problem. If I had inspected the problem diagram and my P~~V~~ and T-s diagrams more closely, I may have realized that it made no sense for the heat exchanger effectiveness to be evaluated at state 4 as I did, and I would have realized that evaluating it at state 5 would be more appropriate, given the system design.

If I were to do the problem again, I would pay more attention to the diagram given with the problem and I would model my work after one of the many Brayton cycle with regeneration examples given in the homework and textbook. I would make sure that I understood where in the system regeneration occurred and how that affected the system's operation. To make my work clearer in the future, I would not call W-dot net (given in the problem description as equal to 500 kW) "Pnet" in the "Purpose" and "Data and Variables" sections and then call it W-dot net in the "Calculations" portion; in the future, I will keep my variable names consistent in all parts of my solution.

My work on Problem 2 demonstrated a lack of understanding that I find concerning; I truly believed that I had a better understanding of the turbojet engine problems. An immediate error that I made was not setting up my P~~V~~ and T-s diagrams correctly. This led to problems when setting my states because I did not find the actual values for states 3 and 5, only the theoretical values. This led to me not using the given turbine & compressor efficiencies and the given compressor work, and not understanding how they were applicable to the problem. I also became confused about how to use variable specific heats and what equations were applicable only to constant specific heats, which affected the work I did while setting my states.

My answer for Part A was wrong and even the methodology was flawed due to the previously mentioned errors. My answer for Part B, V_6 = 844.6 m/s, was also wrong, but the method used to find the answer was correct for the most part; demonstrating some knowledge of how the laws of thermodynamics apply to jet propulsion engines. My method of solving Part C was spot on; the only reason why my answer differed from the posted solution was because of the issues I had when setting my states.

If I were given the chance to do this problem again, I would contact Professor Ayala immediately and ask about the turbine & compressor efficiencies & given compressor work. I suspected that I was misunderstanding something when my work didn't require that information; however, I did not pursue the issue and instead blindly accepted the work I had done as accurate. I would also review the sections on specific heats from MET 300 before performing any calculations. My confusion about how variable specific heats should be used implies that I need to brush up on those concepts; I took MET 300 a year ago so a review would probably help me do better in this course.

The grade I think my test deserves based on the work I did and the work in the posted solution is 70% out of 100%. I believe 10% could be subtracted due to failing to meet the written requirements, specifically on the summary and analysis sections of each problem. I feel Problem 1 could account for a 5% loss in points due to calculation errors or improper setup and Problem 2 could account for a 15% loss in points due improper problem setup. The work I did on this test was flawed and there are concepts that I didn't fully grasp, but the work is based on concepts from this class and MET 300. I used incorrect variations of some equations for the modification or parameters presented, but I still demonstrated that I had the right idea about what base equation should be used in that situation. I set my states and followed a logical path to get the answers that I got; not all my work was accurate, but the procedure for both problems was logical. Based on these strengths and weaknesses, I think a 70% would be fair.

Despite what I may think is fair, following the writing rubric, I feel my analysis for both problems was deficient since I didn't thoroughly discuss the design(s) or make any predictions on how the system would or could be changed; I feel 0 points should be awarded for that. My summaries were also lacking since I condensed my solutions to a single solution box and provided no context for the answers; I feel that deserves 0 points as well. For Problem 1, my state calculations did not include 7 states, so I believe 2/9 points would be appropriate. For part 3 of Problem 1, I believe 1/9 points would be appropriate since I didn't complete the calculations with the appropriate states. I believe parts 4 & 5 of Problem 1 each lost 0.5 point due to calculation errors, making the total points on Problem 1 equal to 5/9. For problem 2, my state calculations did not include 8 states, and I didn't use the compressor work or the compressor & turbine efficiency, so I believe 1/9 points would be appropriate. I believe parts 3, 4, 5 & 6 of Problem 2 each lost 0.5 point due to calculation errors, making the total points on Problem 1 equal to 4/9. Therefore, I earned: $8.5 + 40*(5/9+4/9) = 48.5$ points. The marked-up rubrics that support this grade are at the end of this document.

This test truly tested my knowledge of thermodynamic principles, my patience, and at times, it felt like it tested my sanity. I estimate that I spent approximately 12 hours working on this test over 4 days; in retrospect, I wish I had spent more time on it, but my other courses, full-time job, and personal life demanded some of my time as well. In the future, I will try to write out each test question's "Purpose" – "Materials" section on the first day the test is available so that I can anticipate any issues that I may have setting my states before I run out of time to ask Professor Ayala questions. Though my test answers were not as accurate as I would have hoped, I do feel that this test taught me a valuable lesson about time management and asking questions when I know that I'm struggling to understand a concept.

I know that in my future career as an engineer, my knowledge of all thermodynamic principles will be helpful; however, having the humility to ask for help in a timely manner will be an even more helpful skill since it will help ensure that my designs are as safe and well-thought out as possible, while respecting any deadlines myself or my co-workers are bound by. Though my current job does not require me to perform calculations on systems modeled after the Brayton cycle or figure out how much thrust is generated by a turbojet engine, I do know that this information will be helpful to me in the future and I am dedicated to understanding the concepts taught in this class. I can say that some of the information covered in Chapter 9 has already been useful in my daily life. My general knowledge of gas & diesel engines and how they operate has been greatly improved since the beginning of this class; coincidentally, my current project at work involves swapping out gasoline powered engines for diesel engines and considering the much higher compression ratio of diesel engines has come up frequently. In conclusion, though I did not perform as well as I know I could have on this test, I do feel that I learned from it and am looking forward to applying all of the concepts covered in Chapter 9 and the lessons I learned from this test to my daily life and my future career as an engineer.

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	**0.0/10** out of 0.5/10.0
9. Materials	0.5/10.0 out of 0.5/10.0
10. Analysis	**0.0/10** out of 1.0/10.0
TOTAL	8.5/10 **out of 10.0/10.0**

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Problem solution rubric

	Exceeds Standard	Meets Standard	Approaches Standard	Needs Attention
	4	3	2	1
	10 points	7 points	4 points	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 = 8.5

PROBLEM 1)

1. P-v and T-s diagrams 1/9 out of 1/9
2. State calculations (7 of them – including 5a) 2/9 out of 4/9
   For 6 -> Balance HX using 5a
3. Efficiency and mass flow rate calculation 1/9 out of 2/9
   w_out4-5, w_in1-2 (use isent eff or 5a), qin3-4
4. New HX effectiveness 0.5/9 out of 1/9
5. Final results 0.5/9 out of 1/9

TOTAL 5/9 **out of 9/9**

PROBLEM 2)

1. P-v and T-s diagrams 1/9 out of 1/9
2. State calculations (8 of them – including 3a and 5a) 1/9 out of 4/9
   Use 500 kJ/kg -> Compressor & Turbine
   Cp and Cv are variable
3. Pressure (P5) 0.5/9 out of 1/9
4. Velocity (V6) Use h5a 0.5/9 out of 1/9
5. Thrust 0.5/9 out of 1/9
6. Final results 0.5/9 out of 1/9

TOTAL 4/9 **out of 9/9**

FINAL GRADE (if everything is correct):

10.0 + (80/2)*(9/9+9/9) = 90

Final Grade (Actual) = 8.5 + 40*(5/9+4/9) = 48.5 + 10 HW pts
= 58.5 Pts