

Xavier Nguyen
MET 350 Thermal Applications
Exam One Test Reflection

Rubric for Problem 1

1. P-v and T-s diagrams	
a. Single stage compression (and variations)	1/14
b. Two stages of compression	1/14
2. State calculations	
a. Single stage compression (and variations)	4/14
b. Two stages of compression	0/14
3. Why does regeneration hurt in the original case?	0/14
4. w_{net} , q_{in} , thermal efficiency (all cases)	1.5/14
5. HW effectiveness (all cases)	0/14
6. Which case is better?	0/14
7. Final results	1/14
TOTAL	8.5/14

Rubric for Problem 2

1. P-v and T-s diagrams	1/8
2. State calculations	3.5/8
Use $w_c = w_t$	
Use efficiencies to get actual states	
Cp & Cv variable	
P5, V6	
3. Thrust	1/8
4. Final results	0.6667/8
TOTAL	6.167/8

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

1. Purpose	0.0/10.0
2. Drawings	1.0/10.0
3. Sources	1.0/10.0
4. Design considerations	0.0/10.0
5. Data and variables	0.5/10.0
6. Procedure	2.0/10.0
7. Calculations	2.0/10.0
8. Summary	0.0/10.0
9. Materials	0.0/10.0
10. Analysis	0.0/10.0
TOTAL	4.5/10.0

When comparing my report to the posted solutions, it did not meet the exam standard. I did not follow the exam rubric and did not include enough information. There were no diagrams and only a bare touch of the engineering cost of an engine. Other than that, my report did not consider safety assumptions and other diagrams. While the exam as a whole, I did include diagrams and showed my work and calculations, I did not consider anything else.

TOTAL GRADE: $0/10 + (80/2) * (8.5/14 + 6.167/8) = 55.12$

1) How and why the test demonstrates your work toward one or more of the course learning objectives. Be specific on the course objectives you decide to mention.

The test demonstrates the need to determine certain values using P-v and T-s diagrams to find states for many instances of the Brayton and jet propulsion cycles. The test actively uses the diagrams to find the pressure, temperature, enthalpy, or volume of a state to obtain the net work, heat addition or rejection, and the thermal efficiency of the different cycles. My work clearly shows my understanding of the diagrams required and the math and equations used to solve for each state.

2) How does your test compare against the available solution? State the mistakes you made and what you will do next time to avoid making the same mistakes. Please point out exactly where you made the mistake, say why you made the mistake, and how you should have done it. If you were taking this test again, what advice would you give yourself to ensure that you had a successful test?

Compared to the exam solutions, the mistakes made were: failing to determine the final values of thermal efficiency and regenerator efficiency; and failing to identify the pressure or temperature value at a given state. For example, for problem one, when finding the original Brayton cycle with regeneration, I successfully found the correct pressure and temperature values for all the states. However, I made a mistake by using the wrong formula to calculate thermal efficiency. The equation I used was $1 - \frac{Q_L}{Q_H}$ instead of $\frac{W_{net}}{q_{in}}$. While both equations do

return thermal efficiency, it would have been easier to use $\frac{W_{net}}{q_{in}}$ when solving. When trying to

solve for regenerator efficiency, I knew that the correct formula to use was $\varepsilon = \frac{T_5 - T_2}{T_4 - T_2}$. The

issue was the use of incorrect temperature values. Instead of using $\varepsilon = \frac{T_5 - T_2}{T_4 - T_2}$, I should have

used $\varepsilon = \frac{T_3 - T_2}{T_5 - T_2}$. I made the mistake because I misunderstood where the regenerator was in

the cycle. The regenerator comes before the maximum temperature, not during the process of reaching it. Another issue was in the 2nd part of problem two, when trying to solve for the states in a two-stage compressor. I correctly drew the P-v and T-s diagrams for the two-stage compressor, but made multiple mistakes in determining the states for each stage. For example, when finding stage two, I did not know the correct pressure value $rp_{stage} = \sqrt{rp}$. Because of that, I did not find the correct pressure value for all the states, and I messed up all my calculations. To avoid making the same mistake in the future, it's important to know where the regenerator is in the cycle and to note it before solving for the regenerator efficiency. In the case of the two-stage compressor, it's important to know the pressure relationships at each state to solve for them.

In the case of problem two, the issue addressed was determining the final exit turbine pressure. In my graph, my states ranged from 0 to 5. I correctly determined that the exit turbine pressure

would be at state four. The issue that was raised was calculating the pressure. When trying to find the temperature, I knew that determining the h value required the isentropic compressor/turbine equation. The error was misinterpreting the tables. I correctly determined that T_2 was 751.98K, but when I looked it up, I got the wrong value. As a result, an error was carried forward when trying to perform further pressure calculations. To avoid this, it's important to keep track of table numbers and values to obtain the correct value.

Discuss the following:

a. What issues did you encounter in completing the test? How did you troubleshoot them?

The issues I encountered were trying to use the isentropic compressor/turbine equation to find a h value and then using the tables to obtain a temperature.

b. What steps did you take to complete the whole test? Would you change something?

The first step I took was to draw the P - v and T - s diagrams, then solve for the states. After drawing the diagrams, I used them to help structure the approach to finding the temperature and pressure values for the states. If I could change one thing, I would note down any important information the problem gives me.

c. What new concepts have you learned?

I learned the concepts of the Brayton cycle and the jet propulsion cycle, how they work, and how to find a state's values. Additionally, I have gained an understanding of other cycles, including the Otto cycle, the diesel cycle, and two-stage compression cycles.

d. Where do you think engineers use those concepts (provide specific examples)?

Engineers most commonly use these cycles in various activities, such as engine development. Developing engines involves understanding the cycle to determine where each part of the engine goes. In car engines, they are combustion engines that need gas to start the cycle and get the car moving.

e. Where do you think you will be using everything you learned?

I will apply the concepts I have learned in my current workplace. My current workplace is a Navy Engineering Internship, where I help design ships. One part of the ship is to help design the ship's engine, which helps it move through the water. Knowing how a ship engine's cycle works is crucial to designing and building the engine.

f. Do you think what you learn is important for your professional career?

Yes, what I am learning right now in thermal applications is important for my professional career.

g. How, when, where, and why you might use this information or skill in the future?

I will apply the concepts I have learned in my current workplace. I currently work as a Navy Engineer designing support ships for the Navy. Understanding how certain cycles, such as the diesel cycle, work can help design ship engines. Knowing how the cycle works can help determine how the engine should be shaped and where each part should go.

Have you applied concepts you have learned in the course to what you do at work or in other courses?

Currently, if I had taken this class earlier, I would have applied some of it in heat transfer and some concepts in fluid mechanics, as after taking those classes, some of the material learned previously has shown up in current classes.

i. What areas did you feel you were most successful in, or improved the most?

The areas in which I was most successful were the Brayton cycle and the jet cycles. Solving for the states seemed pretty straightforward, even if I made mistakes. The most improved, I feel, was regarding the variables c_p and c_v . The problems involving variables c_p and c_v require using the tables rather than a straightforward equation. My issue was that I did not understand which equation or where in the table I would use for the values. After completing the exam and the subsequent homework, I feel I have improved at solving variable c_p and c_v problems.

j. How do you see this course's content intersecting with your field or career?

Pursuing a naval engineering career involves having extensive knowledge of thermal applications because many different systems rely on them, such as the diesel cycle for an engine or the jet propulsion cycle for marine propulsion.

k. How much time did you spend on the test? How was the time organized? What would you do differently? Why?

Since the exam was due next week on a Sunday, I spread the exam time evenly. Even though there were only two problems and I had other classes, I spent multiple days on the exams for an hour each to ensure I had ample time to solve them. If I could do something differently, I would prioritize the exam since it is the most important, rather than trying to spread my time evenly.