This test demonstrates my work towards two of the course objectives, “Define different modes of heat transfer, and “Apply the concept of thermal circuit to solve one-dimensional combined mode of heat transfer problems”. Both questions on test required me to be able to analyze and define the modes of heat transfer that were present in the problem in order to solve them. For example, the first problem required that I be able to define and understand convection and conduction throughout the solar collector. The second problem required that I understand the definition of conduction, convection, and realize that the rod was an extended surface to solve for the conductivity of the rod. The first problem on the test required me to apply the concept of thermal circuit to solve for the heat transfer and temperatures throughout the solar collector.

Starting with problem 1, my test is quite similar to the available solution. However, there were a couple mistakes. The first one was the area I used to calculate the amount of incident radiation that was absorbed by the absorber plate and to calculate the thermal resistances due to the convection from the absorber plate to the air space, convection from the air space to cover glass, conduction through the cover glass, and conduction from the cover glass to the ambient air. I assumed an area of 1 square meter. This assumption affected to amount of heat traveling through the thermal circuit, the values of all of the thermal resistances I mentioned previously, and ultimately all of my final results. I should have considered the separation of the copper tubes to establish the width I should have used for the area calculation. The advice I would give myself to have had a more successful test would have been to ask questions when I am unsure. I should not have assumed what area to use. The second mistake I made on this problem was not stating my justification for the shape factor I chose for the conduction through the slab. I should be more cautious in the future and be explicit about my reasoning. The advice I would give myself would be to be more detailed in explanations.

1. Purpose	0.5/10.0
2. Drawings	1.0/10.0
3. Sources	0.5/10.0
4. Design considerations	1.0/10.0
5. Data and variables	0.5/10.0
6. Procedure	2.5/10.0
7. Calculations	2.0/10.0
8. Summary	0.5/10.0
9. Materials	0.5/10.0
10. Analysis	1.0/10.0
TOTAL	**10.0 out of 10.0**

PROBLEM 1)

1. Thermal circuit
    a. 8 resistances 1/14 of 1/14
    b. Q from sun to correct node 1/14 of 1/14
2. Compute individual resistances
    a. Correct areas in the convect resistances 1/14 of 1/14
    b. Shape factor (justification) 0/14 of 1/14
    c. Glass & tube resistance (right eq) 1/14 of 1/14
    d. Absorber resistance is negligible 1/14 of 1/14
3. Conservation of energy equation 1/14 of 1/14
4. Solving for absorber temperature 2/14 of 2/14
5. Q to water 1/14 of 1/14
6. Temp of trapped air 1/14 of 1/14
7. Water mass flow rate 1/14 of 1/14
8. Collector efficiency 1/14 of 1/14
9. Final result 0/14 of 1/14

TOTAL **12/14 of 14/14**

PROBLEM 2)

1. Justification to pick T equation 1/6 of 1/6
2. A=? P=? 1/6 of 1/6
3. m as a function of k 1/6 of 1/6
4. Solving for k 2/6 of 2/6
5. Final results 1/6 of 1/6

TOTAL **6/6 of 6/6**

FINAL GRADE:

10.0 + 55*(12/14) + 25*(6/6) = 82.1

On problem 1, I felt quite strongly in my ability to be able to analyze the drawing and information provided to be able to establish the thermal circuit and understand the direction of heat through the collector. One thing I feel that I have a weakness in is long problems. I often get overwhelmed by the number of terms in an equation. After looking at the available solution for this test, a lesson I have learned is to break up the calculations. I should have calculated each of the thermal resistances independently, then find the resistance equivalent. I put everything together in one equation which can lead to confusion and getting lost in the numbers. I didn't make mistakes because of this, but I think I made the test harder for myself and ultimately took more time. In problem 2, felt quite strong in my ability to look at the problem, determine it was an extended surface, and decide which case to use.

One of the issues I encountered when completing the test was understanding the direction of the heat and which node the heat from the sun started at. I troubleshooted this by asking questions. The steps I use are to reach each question and look at drawings if they are present one at time and not worry about the next question, next I write the purpose, create a drawing, write the sources, design considerations, data and variables, write the procedure based on what needs to be calculated from the purpose, perform the calculations and check my numbers again, read the problem again to ensure that I have solved the problem correctly and answered all parts, write the summary, materials, look back over the problem and write the analysis. I did this for both problems. I wouldn't change anything about it, I believe it worked quite well. I have learned the different modes of heat transfer, how heat transfers through different mediums, how to apply thermal circuits to problems several resistances with different modes of heat transfer. I have learned how to calculate the heat transfer and temperature distribution through a fin.

An example that comes to mind of where engineers would use these concepts is in the automotive industry. If an engineer were designing the cooling system for an internal combustion engine, they would need to look at the amount of heat that needs to be removed from the engine, the flow rate required to keep the engine cool, the size of the radiator, the number of fins required, and many other things. They could apply a thermal circuit from the heat generated by the cylinder to the ambient air outside with many thermal resistances in between. I don't know where I'll be using this in this the future as I haven't decided on the field I want to pursue. However, I am positive that I will need it because heat is everywhere and always needs to transferred to or removed from somewhere. I haven't been able to apply it yet to my work or other courses yet. I spent approximately 4 hours in total working on this test. My time was fairly well organized. More time was spent on the first problem since it was the larger one of the two. I spent approximately two hours on the first, one hour on the second, and about another hour reviewing all my calculations, formatting, and writing.