Approach

The approach below gives a guideline in how to solve the problems presented during this course. Correctly applying this approach will lead to a good understanding of the concepts presented in this course.

Analysis

1 Explain the problem: which physical phenomena are important in this problem?

2 Make a sketch of the problem

3 Give the known variables (with the appropriate units!)

Approach

1 Explain the assumptions you make to solve the problem

2 Show the solution method for solving the problem

Elaboration

1 Show the calculation steps and explain the equations you use

2 Give references if values are found online or in tables

Evaluation

1 Check the units of your solution

2 Is the answer realistic/expected?

3 Did you answer all the questions asked?

4 Iterate if this is required

Assignment 2

Consider a spherical pizza oven, as in the figure. A constant 2 kW of energy is supplied by burning coal. Assume steady-state 1-dimensional heat transfer.

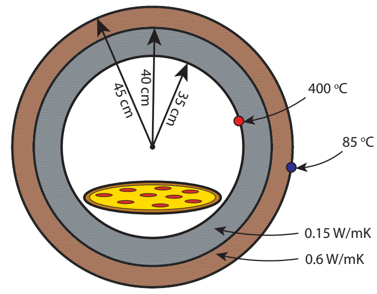

Figure 3: Spherical pizza oven

a) Give the definition of efficiency.

b) What is the efficiency of pizza oven? State the assumptions that are made.

c) Give a sketch of the temperature profile inside the layers of the oven.

Note: Clearly indicate the change in temperature in radial direction, the change in slope at the interface. Lastly, indicate the numerical value of the temperature at the interface

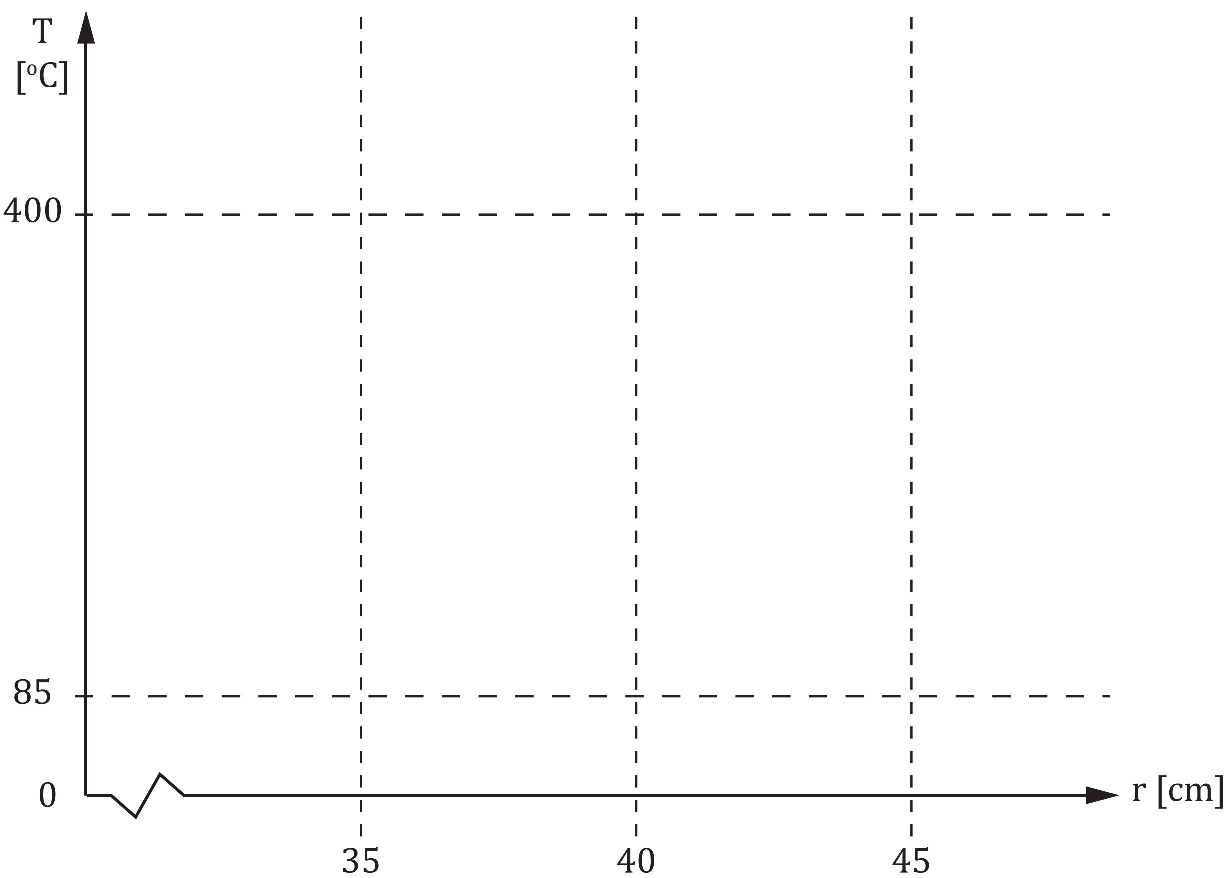

Figure 4: Cross-section of the multi-layer wall

Suppose we have a multi-layer wall, like the one shown, of 8m x 3m. Assume steady-state 1-dimensional heat transfer. The thermal conductivities of each layer can be found in Table 1.

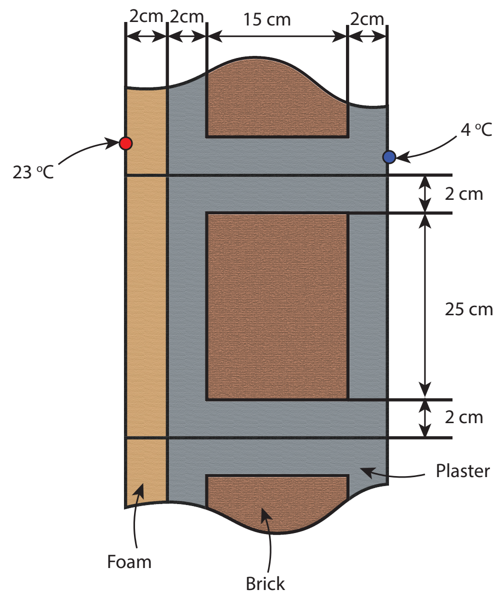

Figure 5: Cross-section of the multi-layer wall

Material	**Thermal Conductivity [W/mK]**
Foam	0.03
Brick	0.75
Plaster	0.24

Table 1: Thermal conductivity of the different layers

d) Provide a sketch of the thermal network. Give an explanation on each component.

e) Determine the rate of heat loss through the entire wall. Assume steady-state conditions.

f) Give an expression for the heat flux through the wall. What would happen to this value if the wall would became twice as long and the surface temperatures remained constant? And what if it became twice as thick?

g) Determine the temperature at the interface between the foam and plaster layer.

h) Rethe ason whether it advisable to make use of the foam layer.