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

Lecture 5

5.1 Heat loss of a person by radiation

A person has an exposed surface of 1.7 m^2, an emissivity of 0.70 and a surface temperature of 32 °C. Determine the rate of heat loss from that person by radiation in a large room whose walls are at a temperature of 27 °C.

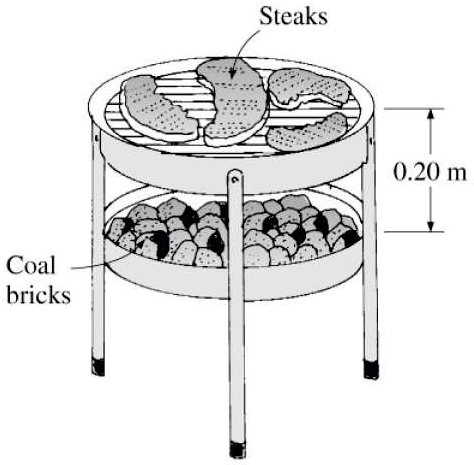
5.2 The BBQ

Consider a circular grill with a diameter of 0.30 m. The bottom of the grill is covered with hot coal bricks at 827 °C, while the mesh on top of the grill is covered with steaks initially at 5 °C. The distance between the coal bricks and the steaks is 0.20 m. Treat both the steaks and the coal bricks as blackbodies.

a) Make a simple diagram of the described situation, with all relevant parameters.

b) Determine the initial rate of radiation heat transfer from the coal bricks to the steaks. Hint: not all the heat radiated by the coal bricks will reach the steaks.

c) Also determine the initial rate of radiation heat transfer to the steaks if the side opening of the grill is covered by aluminium foil, which can be approximated as a re-radiating surface (reflecting all incoming radiation).



5.3 Radiation of heat from a coffee machine

In problem 4.2, the equilibrium temperature of the heater plate surface of a coffee machine has been determined.

a) Find the emissivity ϵ of the heater plate surface.

b) Find the total thermal resistance between the heater surface and the surrounding as well as the total heat transfer coefficient, including convection and radiation.