

Solving Heat Transfer Problems: General Guidelines

A major objective of this learning material is to prepare you to solve engineering problems that involve heat transfer processes. In view of this, several problems are provided and worked out at the end of each module. In working these problems you will gain a deeper appreciation of the fundamentals of the subject, and you will gain confidence in your ability to apply these fundamentals to the solution of engineering problems. It is strongly recommended that the student tries to work out the problems first by himself/herself, before looking at the solutions provided.

In solving heat transfer problems, use of a systematic procedure is advocated. Our experience shows that most heat transfer problems can be tackled by a solution procedure characterized by a prescribed format. This procedure has been consistently employed in all the solutions provided, and we require the students to use it in their problem solutions in the future. The general solution procedure consists of the following steps:

1. Known: After carefully reading the problem, state briefly and concisely what is known about the problem.
2. Find: State briefly what is (are) the quantity (quantities) must be found.
3. Schematic: Draw a schematic of the physical system. If application of the conservation laws is anticipated, represent the required control surface by dashed lines on the schematic. Identify relevant heat transfer processes by appropriately labeled arrows on the schematic. Treat this entire step seriously, as *a good picture paints a thousand words!*
4. Assumptions: List all pertinent simplifying assumptions.
5. Properties: Compile property values need for calculations, and identify sources from where you obtain the values. *Make sure that the source is reliable.*
6. Analysis: Begin your analysis by applying appropriate conservation laws, and introduce rate equations as needed. Develop the analysis as completely as possible before substituting numerical values. *Check the units before substituting any numerical value.* Perform the calculations needed to obtain the desired results.
7. Comments: Discuss your results (even if you are not asked do to so, specifically). Such a discussion may include a summary of key conclusions, a critique of the original assumptions, and an inference of trends obtained. This step will give you additional insights.