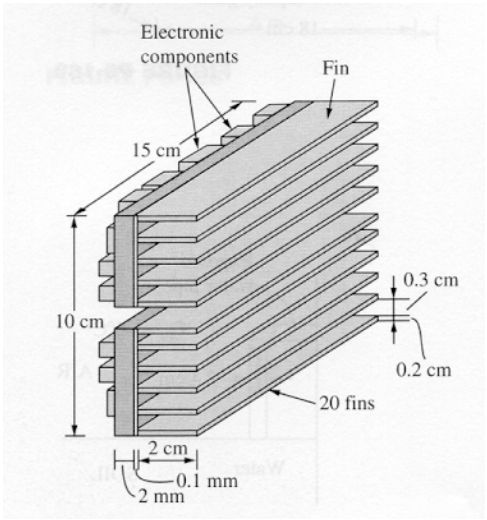
Introduction to Thermodynamics and Heat Transfer (ECE 309)
Suggested Problems for Chapter 8,9

1. A 0.2-cm-thick, 10-cm-high, and 15-cm-long circuit board houses electronic components on one side that dissipate a total of 15 W of heal uniformly. The board is impregnated with conducting metal fillings, and has an effective thermal conductivity of 12 W/(m.°C). All the heat generated in the components is conducted across the circuit board, and is dissipated from the back side of the board to a medium at 37 °C, with a heat transfer coefficient of 45 W /(m2.°C). (a) Determine the surface temperatures on the two sides of the circuit board. (b) Now a 0.l-cm-thick, 10-cm-high, and 15-cm-long aluminum plate [k = 237 W/(m .°C)] with 20 0.2-cm-thick, 2-cm-long, and 15-cm-wide aluminum fins of rectangular profile are attached to the back side of the circuit board with a 0.015-cm-thick epoxy adhesive [k = 1.8 W/(m.°C)]. Determine the new temperatures on the two sides of the circuit board.



2. During a picnic on a hot summer day all the cold drinks disappeared quickly, and the only available drinks were those at the ambient temperature of 25°C. In an effort to cool a 335-ml drink in a can, which is 12.5 cm high and has a diameter of 6.5 cm, a person grabs the can and starts shaking it in the iced water of the chest at 0°C. The temperature of the drink can be assumed to be uniform at all times, and the heat transfer coefficient between the iced water and the aluminum can is 170 W(m^2.°C). Using the properties of water for the drink, estimate how long it will take for the canned drink to cool to 8°C.