Fenómenos de transporte (3007814-2)

Mecanismos de transferencia de calor

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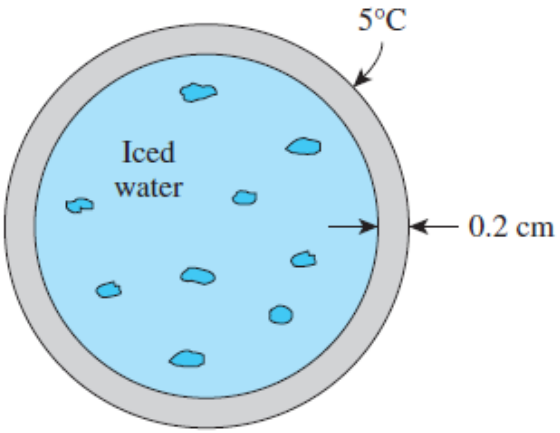
1- The 8-mm-thick bottom of a 220-mm-diameter pan may be made from aluminum (k = 240 W/m K) or copper (k = 390 W/m K). When used to boil water, the surface of the bottom exposed to the water is nominally at 110°C. If heat is transferred from the stove to the pan at a rate of 600 W, what is the temperature of the surface in contact with the stove for each of the two materials?

2- A hollow spherical iron container with outer diameter 20 cm and thickness 0.2 cm is filled with iced water at 0°C. If the outer surface temperature is 5°C,

   a. Determine the approximate rate of heat loss from the sphere, in kW, and the rate at which ice melts in the container.
   b. Plot the rate at which ice melts as a function of the container thickness in the range of 0.1 cm to 1.0 cm. Discuss the results.



3- Air at 40°C flows over a long, 25-mm-diameter cylinder with an embedded electrical heater. In a series of tests, measurements were made of the power per unit length, P', required to maintain the cylinder surface temperature at 300°C for different free stream velocities V of the air. The results are as follows:

Air velocity, V (m/s)	1	2	4	8	12
Power, P' (W/m)	450	658	983	1507	1963

(a) Determine the convection coefficient for each velocity, and display your results graphically.
(b) Assuming the dependence of the convection coefficient on the velocity to be of the form $h = CV^n$, determine the parameters C and n from the results of part (a).

4- Consider a person standing in a room at 18°C. Determine the total rate of heat transfer from this person if the exposed surface area and the skin temperature of the person are 1.7 m^2 and 32°C, respectively, and the convection heat transfer coefficient is 5 $W/m^2 \cdot K$. Take the emissivity of the skin and the clothes to be 0.9, and assume the temperature of the inner surfaces of the room to be the same as the air temperature.

5- Consider a 20-cm thick granite wall with a thermal conductivity of 2.79 W/m·K. The temperature of the left surface is held constant at 50°C, whereas the right face is exposed to a flow of 22°C air with a convection heat transfer coefficient of 15 $W/m^2 \cdot K$. Neglecting heat transfer by radiation, find the right wall surface temperature and the heat flux through the wall.

6- An 800-W iron is left on the iron board with its base exposed to the air at 20°C. The convection heat transfer coefficient between the base surface and the surrounding air is 35 $W/m^2 \cdot K$. If the base has an emissivity of 0.6 and a surface area of 0.02 m^2, determine the temperature of the base of the iron.