

## Chapter 5, Problem 109.

A computer cooled by a fan contains eight PCBs, each dissipating 10 W power. The height of the PCBs is 12 cm and the length is 18 cm. The cooling air is supplied by a 25-W fan mounted at the inlet. If the temperature rise of air as it flows through the case of the computer is not to exceed  $10^{\circ}\text{C}$ , determine (a) the flow rate of the air that the fan needs to deliver and (b) the fraction of the temperature rise of air that is due to the heat generated by the fan and its motor.

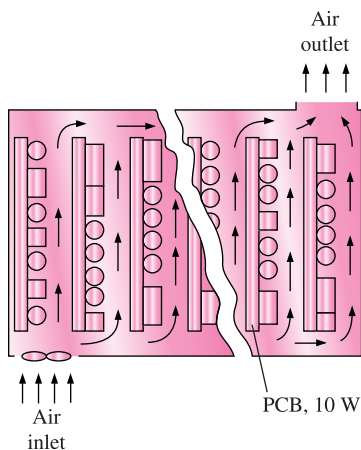




Figure P5-109

\* Problems designated by a “C” are concept questions, and students are encouraged to answer them all. Problems designated by an “E” are in English units, and the SI users can ignore them. Problems with the  are solved using EES, and complete solutions together with parametric studies are included on the enclosed DVD. Problems with the  are comprehensive in nature and are intended to be solved with a computer, preferably using the EES software that accompanies this text.

## Chapter 5, Problem 114.

A hair dryer is basically a duct in which a few layers of electric resistors are placed. A small fan pulls the air in and forces it through the resistors where it is heated. Air enters a 1200-W hair dryer at 100 kPa and 22°C and leaves at 47°C. The cross-sectional area of the hair dryer at the exit is 60 cm<sup>2</sup>. Neglecting the power consumed by the fan and the heat losses through the walls of the hair dryer, determine (a) the volume flow rate of air at the inlet and (b) the velocity of the air at the exit.

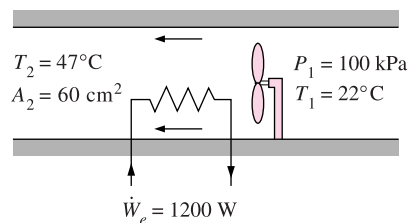




Figure P5-114

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## Chapter 5, Problem 127.

A 2-m<sup>3</sup> rigid tank initially contains air at 100 kPa and 22°C. The tank is connected to a supply line through a valve. Air is flowing in the supply line at 600 kPa and 22°C. The valve is opened, and air is allowed to enter the tank until the pressure in the tank reaches the line pressure, at which point the valve is closed. A thermometer placed in the tank indicates that the air temperature at the final state is 77°C. Determine (a) the mass of air that has entered the tank and (b) the amount of heat transfer.

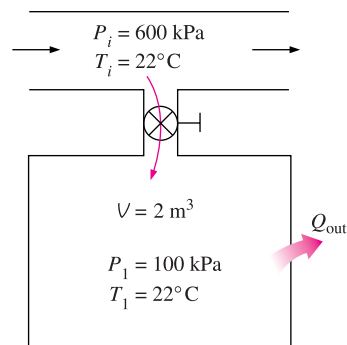




Figure P5-127

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**Chapter 5, Problem 137.**

A 4-L pressure cooker has an operating pressure of 175 kPa. Initially, one-half of the volume is filled with liquid and the other half with vapor. If it is desired that the pressure cooker not run out of liquid water for 1 h, determine the highest rate of heat transfer allowed.

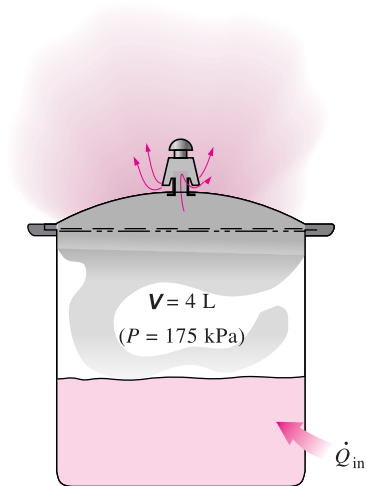




Figure P5-137

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**Chapter 5, Problem 150.**

A long roll of 1-m-wide and 0.5-cm-thick 1-Mn manganese steel plate ( $\rho = 7854 \text{ kg/m}^3$ ) coming off a furnace is to be quenched in an oil bath to a specified temperature. If the metal sheet is moving at a steady velocity of 10 m/min, determine the mass flow rate of the steel plate through the oil bath.

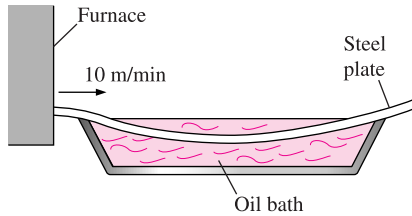




Figure P5-150

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