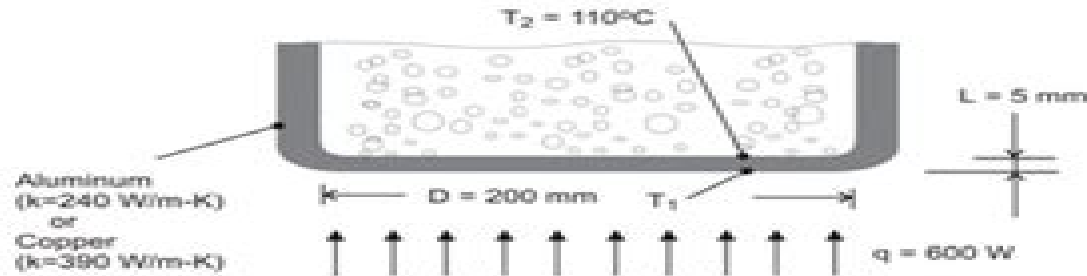


PROBLEM 1.10

KNOWN: Thickness, diameter and inner surface temperature of bottom of pan used to boil water. Rate of heat transfer to the pan.

FIND: Outer surface temperature of pan for an aluminum and a copper bottom.

SCHEMATIC:



ASSUMPTIONS: (1) One-dimensional, steady-state conduction through bottom of pan.

ANALYSIS: From Fourier's law, the rate of heat transfer by conduction through the bottom of the pan is

$$q = kA \frac{T_1 - T_2}{L}$$

Hence,

$$T_1 = T_2 + \frac{qL}{kA}$$

where $A = \pi D^2 / 4 = \pi (0.2\text{ m})^2 / 4 = 0.0314\text{ m}^2$.

$$\text{Aluminum: } T_1 = 110^\circ\text{C} + \frac{600\text{ W} (0.005\text{ m})}{240\text{ W/m}\cdot\text{K} (0.0314\text{ m}^2)} = 110.40^\circ\text{C}$$

$$\text{Copper: } T_1 = 110^\circ\text{C} + \frac{600\text{ W} (0.005\text{ m})}{390\text{ W/m}\cdot\text{K} (0.0314\text{ m}^2)} = 110.25^\circ\text{C}$$

COMMENTS: Although the temperature drop across the bottom is slightly larger for aluminum (due to its smaller thermal conductivity), it is sufficiently small to be negligible for both materials. To a good approximation, the bottom may be considered *isothermal* at $T = 110^\circ\text{C}$, which is a desirable feature of pots and pans.

Heat Transfer Incropera 5th Edition Solution Manual

Jin-Ying Zhang



Heat Transfer Incropera 5th Edition Solution Manual:

Student Study Guide to accompany Introduction to Heat, 4th Edition and Fundamentals of Heat, 5th Edition Frank P. Incropera, David P. DeWitt, 2004-12-17 Work more effectively and gauge your progress as you go along This Student Study Guide and Solutions Manual has been developed by the publisher as a supplement to accompany Incropera's Fundamentals of Heat Mass Transfer 5th Edition and Introduction to Heat Mass Transfer 4th Edition It contains a summary of key concepts from each chapter fully worked solutions to representative problems from the text and in many cases includes exploration of a solution over a range of values using the software package Interactive Heat Transfer v2.0 This supplement is intended to help students focus on the key concepts from the text verify their solutions by comparing them to the authors own worked solutions and use computer tools to explore the behavior of the systems in question Each worked solution follows the structured problem solving approach from the text Comments throughout the solution help in explaining the thought process and a Comments section at the end of each solutions discusses reasonableness and or implications of the answer Introduction to Heat Transfer 4th Edition the de facto standard text for heat transfer is noted for its readability comprehensiveness and relevancy Now revised to include clarified learning objectives chapter summaries and many new problems The fourth edition like previous editions continues to support four student learning objectives desired attributes of any first course in heat transfer 1 Learn the meaning of the terminology and physical principles of heat transfer delineate pertinent transport phenomena for any process or system involving heat transfer 2 Use requisite inputs for computing heat transfer rates and or material temperatures 3 Develop representative models of real processes and systems 4 Draw conclusions concerning process systems design or performance from the attendant analysis As a best selling book in the field Fundamentals of Heat Mass Transfer 5th Edition provides a complete introduction to the physical origins of heat and mass transfer Noted for its crystal clear presentation and easy to follow problem solving methodology Incropera and Dewitt's systematic approach to the first law develops reader confidence in using this essential tool for thermal analysis

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