SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY
Department of Materials and Metallurgical Engineering

Met 422 Chapter 07 – Product Solution & Gr# Due 11:00 pm Nov 05

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1) A 10-cm thick Al flat plate at 425 C is quenched in a room-temperature oil bath without agitation. How long will it take for the center of the plate to reach 200 C? k_{Al} = 230 W/m*K , h = see Table 8.1 (270 W/m^2*K), The thermal diffusivity of Al may be assumed to be 0.125 cm^2/s.

2) A long 10x20-cm Al bar at 425 C is quenched in a room-temperature oil bath without agitation. What temperature will the center of the bar reach after 5 minutes? Use the thermal data given in Problem #1

3) A long 10x20-cm Al bar at 425 C is quenched in a room-temperature oil bath without agitation. What temperature will be reached after 3 minutes at center of the 10-cm thickness and 3 cm from the center in the 20-cm thickness? Use the thermal data given in Problem #1

4) A long 10-cm diameter Al rod at 425 C is quenched in a room-temperature oil bath without agitation. What temperature will be reached after 4x72 seconds at center of the rod and 3 cm from its end? Use the thermal data given in Problem #1. Since dimensionless temperature in Figure 9.16 is the *compliment* of the dimensionless temperature in Figs. 9.8-10, use (1-S) from figure 9.16 so that the temperature runs from 1 to 0 for the semi-infinite solution. That is, the product solution requires all dimensionless temperatures run from 1 at t = 0 to 0 at $t = \infty$.

5) A long 10-cm diameter Al rod at 425 C is quenched by natural convection in room-temperature air. What temperature will be reached after 10 minutes at center of the rod? Use Fig. 8.8 to get h.
k_{Al} = 230 W/m*K, α_{Al} = 0.125 cm^2/s, h = from Fig 8.8