Name: _____ A#: _____

MAE 3440: HW #8

Due March 13, 2020

1. A 1 m^2 slab of mild steel leaves a forging operation with a thickness of 0.5 cm at 1,000°C. It is laid flat on an insulating bed and 27°C air is blow over the top side at 30 m/s. How long will it take for the hottest part to reach 200°C? Clearly state all your assumptions.

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2. Water at 37°C flows at 3 m/s across a 6 cm diameter tube that is held at 97°C. In a second configuration, 37°C water flows at an average velocity of 3 m/s through a bundle of 6 cm diameter tubes that are held at 97°C. The bundle is staggered, with $S_T/S_L = 2$. Compare the average heat transfer coefficients for the two situations.

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3. Copper spheres of 20 mm diameter are quenched by being dropped into a tank of water that is maintained at 280 K. The spheres may be assumed to reach the terminal velocity of 2.2 m/s on impact and to drop freely through the water. What is the approximate height of the water tank needed to cool the spheres from an initial temperature of 360 K to a center temperature of 320 K?