Tutorial Problem

Q. The temp. of a gas is to be measured by a thermocouple whose junction can be approximated a a 1- mm dia sphere, The properties of junction are $k = 35\ W/m.K$, $\rho = 8500\ kg/m^3$, $c_p = 320\ J/kg.K$, and the convection heat transfer coeff. between the junction and gas is. $h = 210\ W/m^2.K$. Determine how long will it take for the thermocouple to read 99% of the initial temp. diff.

$$L_c = \frac{\frac{1}{6}\pi D^3}{\frac{1}{2}D} = 1.67 \times 10^{-4}$$

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