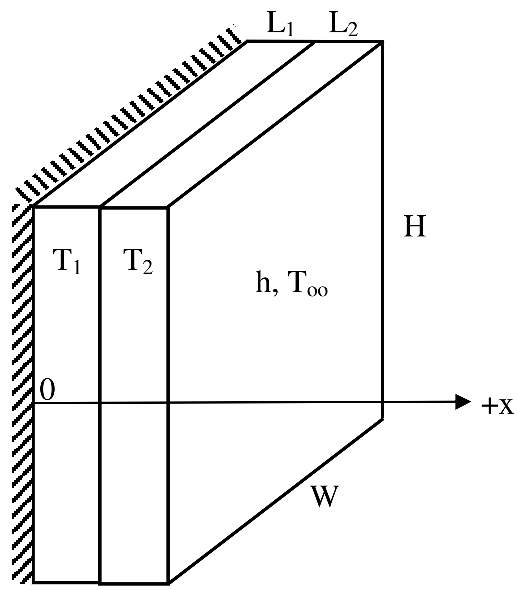
Problem 1) Consider a composite wall, as shown in the figure below. The left portion of the wall is of thickness L_1, made of Material 1 (with thermal conductivity k_1), and will be characterized by dependent variable T_1. The right portion of the wall is of thickness L_2, made of Material 2 (with thermal conductivity k_2), and will be characterized by dependent variable T_2. Initially, the entire wall is at a uniform temperature T_i. The x-axis is shown on the figure, where x=0 is the left most boundary of the wall, and $x = (L_1 + L_2)$ is the right most boundary of the wall. At time = 0, the left side of the wall (x=0) is perfectly insulated, while the right side ($x= L_1 + L_2$) is subjected to convection heat transfer with a uniform convection coefficient h (W/m^2 K) and fluid temperature T_{oo}, noting that $T_i < T_{oo}$. The contact resistance between Material 1 and Material 2 is negligible. In addition: $Bi_1 = (hL_1/k_1)$ is much less than 1, $Bi_2 = (hL_2/k_2)$ is equal to 1, and H & W are both much greater than L_1 and L_2.

(**i**) In consideration of the parameters and problem statement described above, formulate the problem to solve for the temperatures T_1 and T_2. Formulation includes all relevant governing equations and boundary conditions/initial conditions reduced to the simplest form.
You do not need to solve the equations.

(**ii**) Sketch T(x) from $0 < x < (L_1 + L_2)$ for (a) t=0; (b) a small time after t=0; (c) an intermediate time; (d) a relatively long time; and (e) for steady-state. Put all five plots on the same graph, and label the curves (a) through (e).

(**iii**) Sketch q''(t) at the position $x = L_1$ and at the position $x = (L_1 + L_2)$. Put these two curves on together on the same graph, and give attention to, slope, sign, and relative magnitude.



Problem 2) A solid cylinder is shown below of radius **b** and of length **L**, such that b ~ L. The cylinder is subjected to uniform, incident heat flux q''_o (W/m^2) around the entire curved surface. The left flat surface is maintained at constant, uniform temperature T_{oo}, and the right flat surface is subjected to convection heat transfer with a uniform convection coefficient h (W/m^2 K) and fluid temperature T_{oo}.

(**i**) Solve for the steady-state temperature distribution of the cylinder. Clearly define your coordinate system and origin.

(**ii**) Provide an expression for conservation of energy between the curved and the flat surfaces.

You may leave integrals in answers as necessary.