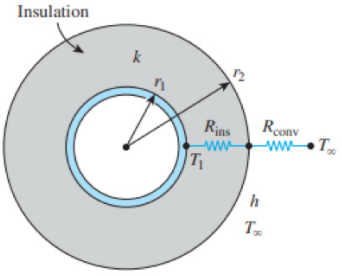
Assignment-02

Consider a cylindrical pipe of outer radius r1 whose outer surface temperature T1 is maintained constant. The pipe is now insulated with a material whose thermal conductivity is k and outer radius is r2. Heat is lost from the pipe to the surrounding medium at temperature T`, with a convection heat transfer coefficient h. Plot Q(heat transfer) vs r for the sphere.



In cylinder; $R_{cylinder} = R_{ins} = \frac{\ln[r_2/r_1]}{2\pi kL}$

$$R_{conv.} = \frac{1}{hA}$$

$$\therefore R_{total} = \frac{\ln[r_2/r_1]}{2\pi kL} + \frac{1}{h[2\pi r_2 L]}$$

$$\therefore \dot{Q} = \frac{\Delta T}{R_{total}}$$

$$\dot{Q} = \frac{\Delta T}{\frac{\ln(r_2/r_1)}{2\pi kL} + \frac{1}{h(2\pi r_2 L)}}$$

finding $r_{critical}$

$$\frac{dR_{total}}{dr_2} = 0.$$

$$\Rightarrow \frac{1}{2\pi kLr_2} - \frac{1}{h2\pi r_2^2 L} = 0$$

$$\Rightarrow h2\pi r_2^2 L = 2\pi kLr_2$$

$$\rightarrow r_2 = \frac{k}{h} = r_{critical}$$