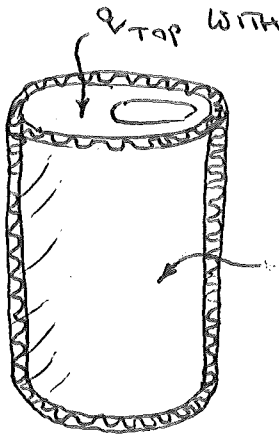
#3

PART 1 : QUITE STRAIGHT FORWARD ... NO HINT REQUIRED.

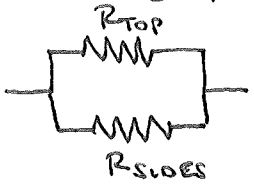
PART 2 :



THESE ARE TWO PARALLEL HEAT TRANSFER PATHS.

THAT MEANS YOU CANNOT SIMPLY ADD THE TWO THERMAL RESISTANCES AS THOUGH THEY WERE IN SERIES.

TO DEAL WITH THIS PARALLEL SITUATION ...



$$\frac{1}{A_{TOTAL}\,R_{OVERALL}} = \frac{1}{A_{TOP}\,R_{TOP}} + \frac{1}{A_{SIDES}\,R_{SIDES}}$$

SOLVE FOR THIS AND USE IT HERE

$$\frac{1}{hA_{TOP}} \qquad \frac{L}{kA_{SIDES}} + \frac{1}{hA_{SIDES}}$$

NOW YOU CAN WORK OUT THE WARMING TIME ...

RECALL: $$\boxed{\frac{T(t) - T_\infty}{T_i - T_\infty} = e^{-bt}} \quad (18-4).$$

FOR JUST AIR FILM COVERED SURFACES ...

$$b = \frac{hA_s}{\rho V C_p}$$

[AS DISCUSSED IN THE TUTORIAL ... $R = \frac{1}{hA}$ IN THIS CASE.]

FOR GENERAL INSULATION CONDITIONS ...

$$\boxed{b = \frac{1}{R_{OVERALL} \times \rho V C_p}} \quad (\text{MODIFIED } 18-5)$$