

Heat Transfer Questions & Answers

Question by Student 201427132

Dear professor, i have some question about today's class.

First of all, i understand that phase change makes matter change properties.

In last example, i think you solve the problem assuming it is steady state.

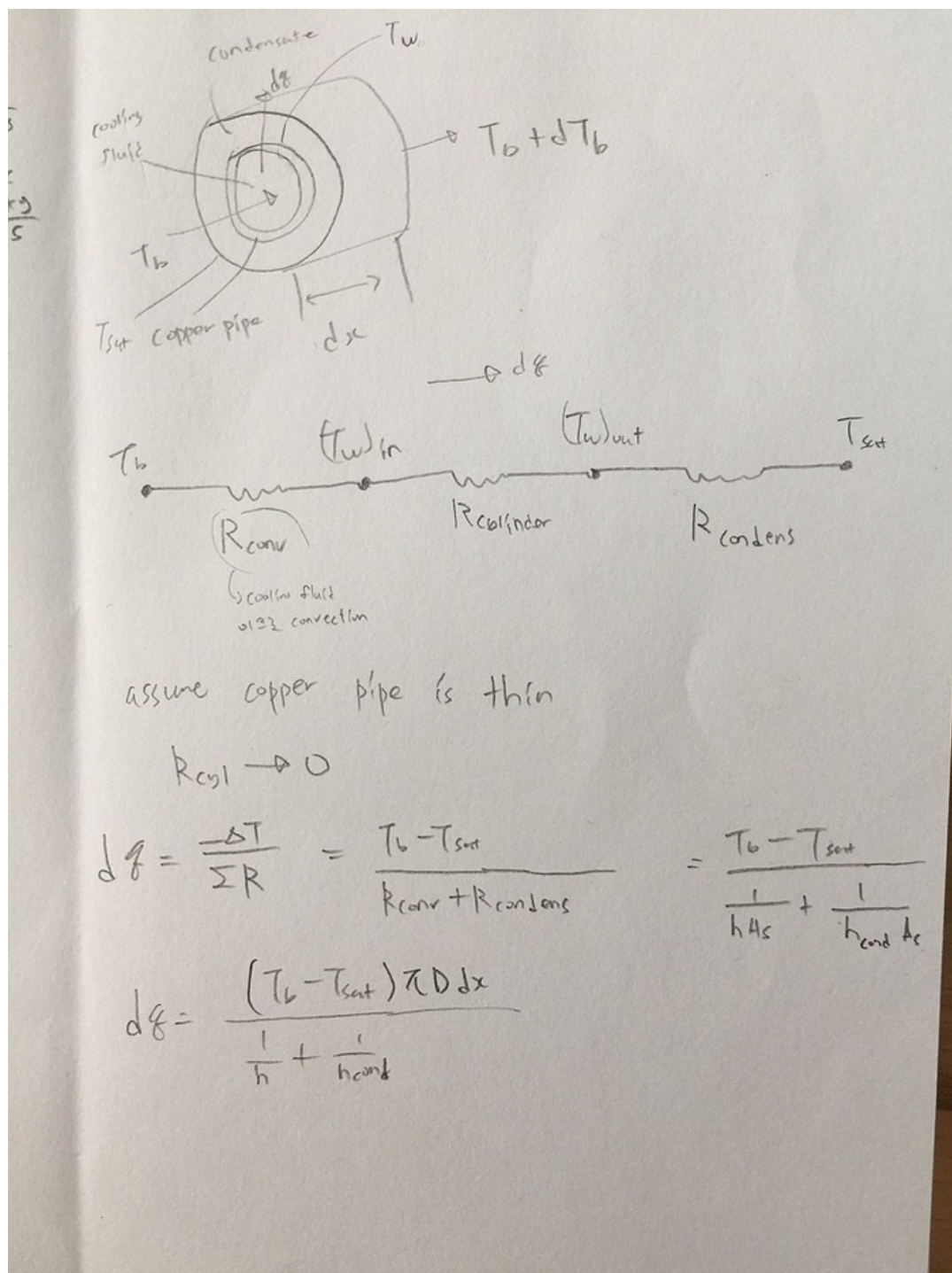
But, phase change makes matter change in time.

I guess it does not make sense..

Yes phase change makes matter change in time if the reference frame is set on the fluid going through the phase change. But if the reference frame is set on the pipe, then phase change can become steady. 1 point bonus.

Question by Student 201127102

Dear professor, I have question for today's class.



In equation of dq , attached, I guess Surface area of R_{conv} and R_{cond} are different from each other.

But i have no idea that why you think A_s of R_{conv} and R_{cond} are same.

Is there specific reason for this?

For convective heat transfer, the surface area when using the equation $q = A_s h \Delta T$ should always be measured at the fluid-solid interface (where the solid touches the fluid). Because the solid here has negligible thickness, the surface area is the same for the convective heat transfer taking place within or outside the pipe. 1.5 points bonus.

Dear professor, I have a question about conductivity(k). In many case, k can be used in solid. But in No.3 assignment #7, it has k of gas. What is difference between conductivity in gas and conductivity in solid?

As we saw in the first weeks of this course, k is derived for a gas and extended by analogy to solids and liquids. This was explained already. 0.5 point bonus.

Question by Student 201327557

Hello professor parent. In assignment #8, question 2. To solve the problem I have to find the convective heat transfer coefficient of external flow. But to find the convective heat transfer coefficient I need Nusselt number. First, I found the Reynolds number with the T_f which I assumed $T_w = T_{air}$. In table, summary of convection correlations for external flow across cylinders, tube banks, and spheres, there are two options that I can choose but I don't know what is Pe in first row.

Pe should be written as Pe_d : that's the Peclet number as defined on the second page of the tables. 2 points bonus.

Question by Student 201227127

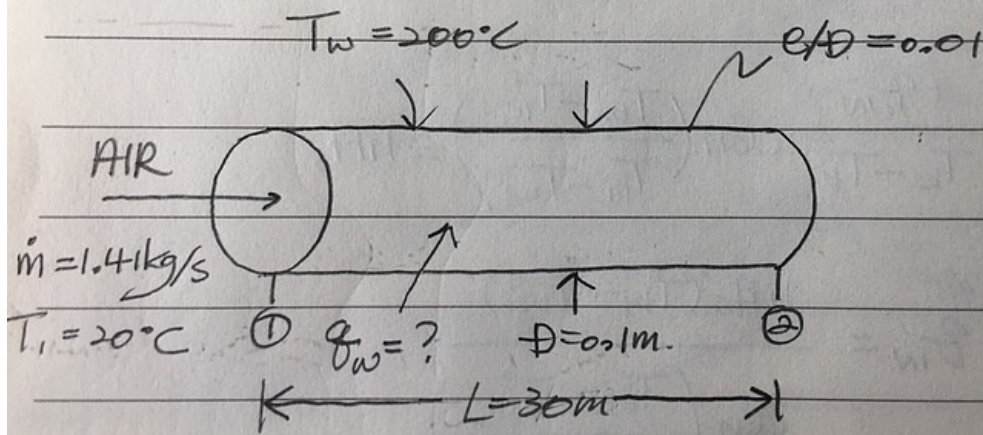
Hi professor, I have question about A8, Q2. To solve problem, I used $q_{waterin} = q_{airout}$ concept. So I have to find external and internal convective heat transfer coefficient. All properties of Nusselt number of external flow evaluated at film Temperature. And in internal flow, to get h , we need average bulk temperature. but we don't know both wall temperature and exit bulk temperature. I think I have to guess 2 temperature. Is it right?

Sure, you should proceed iteratively as shown in class.

Question by Student 201127151

Professor, I have a question about the log mean temperature difference. You explained the LMTD EG :

LMTD EG.



And Solving the example, you used the following equations :

$$q_w = \frac{hA_s(T_{b1} - T_{b2})}{\ln\left(\frac{T_w - T_{b2}}{T_w - T_{b1}}\right)} \quad (1)$$

and

$$q_{in} = \dot{m}c_p(T_{b2} - T_{b1}). \quad (2)$$

When heat is transferred to the pipe, I think that the equation (1) and (2) have positive values. If so, I think that the equation (1) is directly equal to the equation (2). But you used a negative sign as follow :

$$\dot{m}c_p(T_{b2} - T_{b1}) = - \frac{hA_s(T_{b1} - T_{b2})}{\ln\left(\frac{T_w - T_{b2}}{T_w - T_{b1}}\right)}$$

Which one is correct?

Yes, $q_w = q_{in}$. The following is wrong:

$$\dot{m}c_p(T_{b2} - T_{b1}) = - \frac{hA_s(T_{b1} - T_{b2})}{\ln\left(\frac{T_w - T_{b2}}{T_w - T_{b1}}\right)}$$

I guess I meant:

$$\dot{m}c_p(T_{b2} - T_{b1}) = - \frac{hA_s(T_{b2} - T_{b1})}{\ln\left(\frac{T_w - T_{b2}}{T_w - T_{b1}}\right)}$$

Change the sign if necessary. 2 points bonus.