# Heat Transfer Questions & Answers

### Question by Student 201427103

*Dear Professor.*
*I am writing to ask you a question while solving Question # 5 in Assignment 7.*
*The condition given is Constant Heat Flux. So I referred to the given table.*

*According to this table, I see "Constant heat flux, local h " . So I did the same process as the attached picture to prove the assumption that h is also constant.*

*The results show satisfaction when the m is 1/4.*
*However, if Gr * is greater than 10ˆ5 and less than 10ˆ11, then the last equation attached to the picture will not be formed.*
*How do I interpret this?*

*Additionally, I am having difficulty solving this Question # 5 in Assingment 7. Do you have any suggestions for our?*

*Thank you.*

KakaoTalk_20180609_155626471.jpg

You have to use LaTeX for the math. Use an attached figure only for a schematic. Also, avoid breaking lines. One question is one paragraph (one idea). Breaking lines makes it hard for me to read your question.

### Question by Student 201427103

*Dear Professor. I am writing to ask you a question while solving Question # 5 in Assignment 7. The condition given is Constant Heat Flux. So I referred to the given table. According to this table, I see "Constant heat flux, local h " . So I did the process as the attached picture to prove the assumption that h is also constant. (The reason for this is that if h is the constant, the average value is the same value h.) The results show satisfaction when the*

$$m = \frac{1}{4}$$

*However, if Gr **

$$10^5 < Gr^* < 10^{11} \tag{1}$$

*then the last equation attached to the picture will not be adapt. because according to Table this condition,*

$$m = \frac{1}{5}$$

*so How do I interpret this?*

KakaoTalk_20180609_155626471.jpg

Again, all the math should be written in LaTeX. Don't attach a picture with mathematics. If there's a derivation you wish to discuss, then write it all here using LaTeX.

### Question by Student 201427103

*I'm sorry, but I've got the exact meaning now. Let's recreate the attached expression.I am writing to ask you a question while solving Question 5 in Assignment 7. The condition given is Constant Heat Flux. So I referred to the given table. According to this table, I see "Constant heat flux, local h " . So I did the process to prove the assumption that h is also constant.(The reason for this is that if h is the constant, the average value is the same value h.) first*

$$Gr^* = \frac{g\rho^2\beta q_w x^4}{k\mu^2} \tag{2}$$

$$Nu_x = \frac{hx}{k} = C(Gr^* Pr)^m = C(\frac{g\rho^2\beta q_w x^4}{k\mu^2}Pr)^m$$

*In reference to this equation (1) . The following is a summary of h.*

$$h = \frac{Ck}{x}(Gr^* Pr)^m = Ck(\frac{g\rho^2\beta q_w}{k\mu^2}Pr)^m(x^{4m-1}) \tag{3}$$

*Let's now measure the average value of h.*

$$\bar{h} = \frac{\int_0^L h\,\mathrm{d}x}{L} = \frac{\int_0^L Ck(\frac{g\rho^2\beta q_w}{k\mu^2}Pr)^m(x^{4m-1})\,\mathrm{d}x}{L} = \frac{Ck(\frac{g\rho^2\beta q_w}{k\mu^2}Pr)^m}{L}\frac{1}{4m}x^{4m} \tag{4}$$

$$= \frac{k(C(\frac{g\rho^2\beta q_w x^4}{k\mu^2}Pr)^m)}{4mL}$$

*Therefore, the average value of the final Nu :*

$$N\bar{u}_L = \frac{\bar{h}L}{k} = \frac{1}{4m}C(\frac{g\rho^2\beta q_w x^4}{k\mu^2}Pr)^m \tag{5}$$

*To satisfy the first assumption here , m value have to be*

$$m = \frac{1}{4}$$

*but If you look at the table, when the Gr value are:*

$$10^5 < Gr_x^* < 10^{11} \tag{6}$$

*The m value is*

$$m = \frac{1}{5}$$

*Therefore, under (5) conditions, we were able to confirm that we were not satisfied. Why is this so? I want to know.*
*Thank you for your patience Professor.*

Hmm, I am not sure if I am following you correctly. Why do you say the value for $m$ is $1/4$ to satisfy assumption (1) for an average $h$? This doesn't make sense. The value for $m$ is $1/5$ if $\mathrm{Gr}_x^* \lessapprox 10^{12}$ and $1/4$ otherwise. If you wish to integrate $h$ over a large Grashoff number range with a lower limit less than $10^{11}$ and an upper limit greater than $10^{13}$, then you need to split the integral in 2 and use two different $m$s. 0.5 point bonus for the effort.

### Question by Student 201527143

*Professor, I dont know how to choose differential form eqn or integral form eq for the volume. I understand integral form from the notebook eg. However, I dont understand when I should use differential form. Please let me konw.*

You have to use the differential form when the integral form can not give you the answer. For instance, you may need it when trying to find $q''$ just near the surface for a solid with a non-constant thermal conductivity.

### Question by Jaehyuk

*Professor, I have a question about A1Q6. If $h_1$ (heat transfer coefficient on the left wall) is not given, there are two equations(heat equation and convection-radiation balance) with three unkowns, so that it is impossible to solve. Is there other ways to find $h_1$ ?*

Hint: you don't need the data left of the block or within the block to find (a) or (b). You only need the temperature on the right side of the block. Think about it more.

### Question by Jaehyuk

*Professor, again I have question about A1Q6. Last time, you told me that $h_1$ is not needed to solve (a) and (b). However, does this also applied to (c) and (d)?*

Because $h_1$ is not given in the question statement, it is not needed to solve the problem. Once (a), (b), (c), and (d) are found, you can find $h_1$ if you wish, but that is not necessary.