Quiz

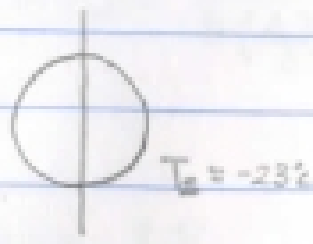
D = 1.2 cm — 1.15 W

$V_\infty = 2 \frac{m}{s}$

$T_s = -23°C$

$T_\infty = 27°C$

Eq 7.48 $\overline{Nu}_D = 2 + (\quad)(\frac{Pr}{Pr_s})^{1/4}$ ← where does this come from?



$2.29 \frac{k}{k} \frac{1}{r^2} \frac{d}{dr}\left(k r^2 \frac{dT}{dr}\right) = \frac{0}{k} \rightarrow \frac{1}{r^2} \frac{d}{dr}\left(r^2 \frac{dT}{dr}\right) = 0$

$T(r_o) = -23°C$

$T(r \to \infty) = 27°C$

$\frac{d}{dr}\left(r^2 \frac{dT}{dr}\right) = 0\, dr$

$\int d\left(r^2 \frac{dT}{dr}\right) = \int 0\, dr \rightarrow r^2 \frac{dT}{dr} = C_1$

$\frac{dT}{dr} = \frac{C_1}{r^2} \rightarrow dT = \frac{C_1}{r^2} dr \rightarrow \int dT = \int \frac{C_1}{r^2} dr$

$T = \frac{C_1 r^{-1}}{-1} + C_2 \rightarrow T = C_2 - \frac{C_1}{r}$

$T(r \to \infty) = 27°C = C_2 - \frac{C_1}{\infty} \rightarrow C_2 = 27°C$

$T(r_o) = -23°C = 27°C - \frac{C_1}{r_o}$ $\therefore -23 - 27°C = \Delta T$

$\rightarrow C_1 = \Delta T r_o$

$T(r) = T_\infty + \frac{\Delta T r_o}{r} \rightarrow \frac{dT}{dr} = -\frac{\Delta T}{r^2} r_o \Big|_{r_o} = \frac{dT}{dr} = \frac{-\Delta T}{r_o}$

$q = A k \frac{dT}{dr}\Big|_{r_o} = -A k \frac{\Delta T}{r_o} = -hA\Delta T \rightarrow \frac{h r_o}{k} = 1$ $\therefore 2r_o = D$

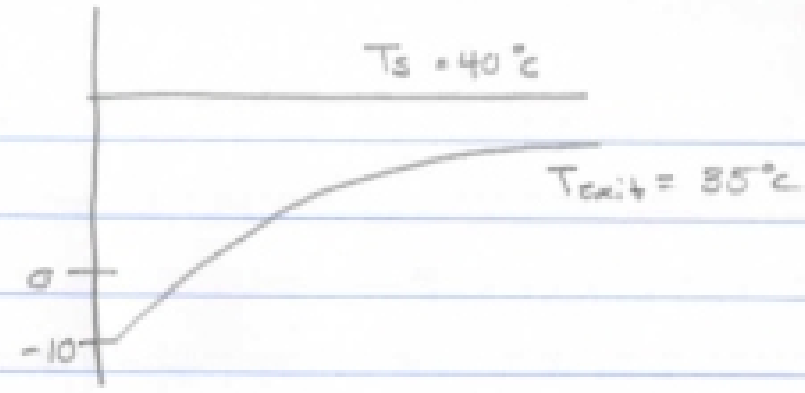
$\frac{2hr_o}{k} = 2$ $\quad \overline{Nu}_D = 2$

$q = hA\Delta T$

$= h(PL)\Delta T$

$\hookrightarrow P = \pi D$

$q = h\pi DL\Delta T_{LM}$



$$\Delta T_{lm} = \frac{\Delta T_{in} - \Delta T_{out}}{\ln\left(\frac{\Delta T_{in}}{\Delta T_{out}}\right)} = \frac{40-(-10) - 40-35}{\ln\left(\frac{90}{5}\right)} = 19.5°C$$

Example 8.5

to be completed on 7/2/2014