Corrigé Interrogation N°2

Exercice 01 (7.5 pts)

1. $R_e = \frac{\rho.U.D}{\mu} = \frac{\rho.\frac{Q}{\rho.S}.D}{\mu} = \frac{Q.D}{S.\mu} = \frac{Q.D}{\frac{\pi D^2}{4}.\mu} = \frac{4.Q}{\pi.D.\mu} = \frac{4.\frac{3}{60}}{\pi.10^{-2}.10^{-3}} = 6366,2$ **(1pt)**

$R_e > 2400$ Régime turbulent **(0.25pts)**

$P_r = \frac{\mu C_p}{\lambda} = \frac{10^{-3}.4180}{0,64} = 6,531 > 0,7$ **(0.5pts)**

$N_u = 0,023 . P_r^{0,4} . R_e^{0,8} = 0,023.(6,531)^{0,4}.(6366,2)^{0,8} = 53,8$ **(1pt)**

$h = \frac{N_u . \lambda}{D} = \frac{53,8 . 0,64}{10^{-2}} = 3,443 . 10^3 \ W/m^2.K$ **(0.5pts)**

$\phi = h.S.(T_f - T_p) = h.\pi.D.L.(T_f - T_p)$ **(0.5pts)**

$\phi = 3,443 . 10^3 . \pi . 10^{-2} . 10 . (100 - 10) = 97,35W$ **(0.5pts)**

2. $R_e = \frac{\rho.U.D}{\mu} = \frac{\rho.\frac{Q}{\rho.S}.D}{\mu} = \frac{Q.D}{S.\mu} = \frac{Q.D}{\frac{\pi D^2}{4}.\mu} = \frac{4.Q}{\pi.D.\mu} = \frac{4.\frac{3}{60}}{\pi.4.10^{-2}.10^{-3}} = 1591,55$ **(1pt)**

$R_e < 2400$ Régime laminaire **(0.25pts)**

A= x / (R_e . P_r .r)= 25 / (1591,55 . 6,531.0,02)=**0,12 >0.1** **(0.5pts)** alors N_u=**3,66** **(0.5pts)**

$h = \frac{N_u . \lambda}{D} = \frac{3,66 . 0,64}{4.10^{-2}} = 58,56 \ W/m^2.K$ **(0.5pts)**

$\phi = h.\pi.D.L.(T_f - T_p) = 58,56 . \pi . 4 . 10^{-2} . 25 . (30 - 28) = 368 W$ **(0.5pts)**

Exercice 02 (7.5 pts)

I.

1. $M_{0_T} = \varepsilon.\sigma.T^4 \Rightarrow \phi = S.\varepsilon.\sigma.T^4 = \pi.D.L.\varepsilon.\sigma.T^4$ **(0.5pts)**

$T = \sqrt[4]{\frac{\phi}{\pi.D.L.\varepsilon.\sigma}} = \sqrt[4]{\frac{1000}{\pi . 0,2 . 1 . 0,7 . 5,67.10^{-8}}} = 447,5K = 174,35°C$ **(1pt)**

2. $\lambda_M = \frac{2898.10^{-6}}{T} = \frac{2898.10^{-6}}{447,5} = 6,47 . 10^{-6} m = 6,47\mu m$ **(1pt)**

3. $T = \frac{2898.10^{-6}}{8.10^{-6}} = 362,25K = 89,1°C$ **(1pt)**

4. $\phi = S.\varepsilon.\sigma.T^4 = \pi.D.L.\varepsilon.\sigma.T^4 = 429,43W$ **(1pt)**

II.

1. $M_{0_T} = \sigma.T^4 \Rightarrow \phi = S.\sigma.T^4$ **(0.5pts)**

$\phi = 4\pi R^2.\sigma.T^4 = 4\pi(5.10^{-2})^2.5,67.10^{-8}.(327 + 273,15)^4 = 231,1W$ **(1pt)**

2. $M_{12} = \sigma.(T_1^4 - T_2^4)$ **(0.5pts)**

$M_{12} = 5,67.10^{-8}.(400^4 - 300^4) = 992,25W/m^2$ **(1pt)**