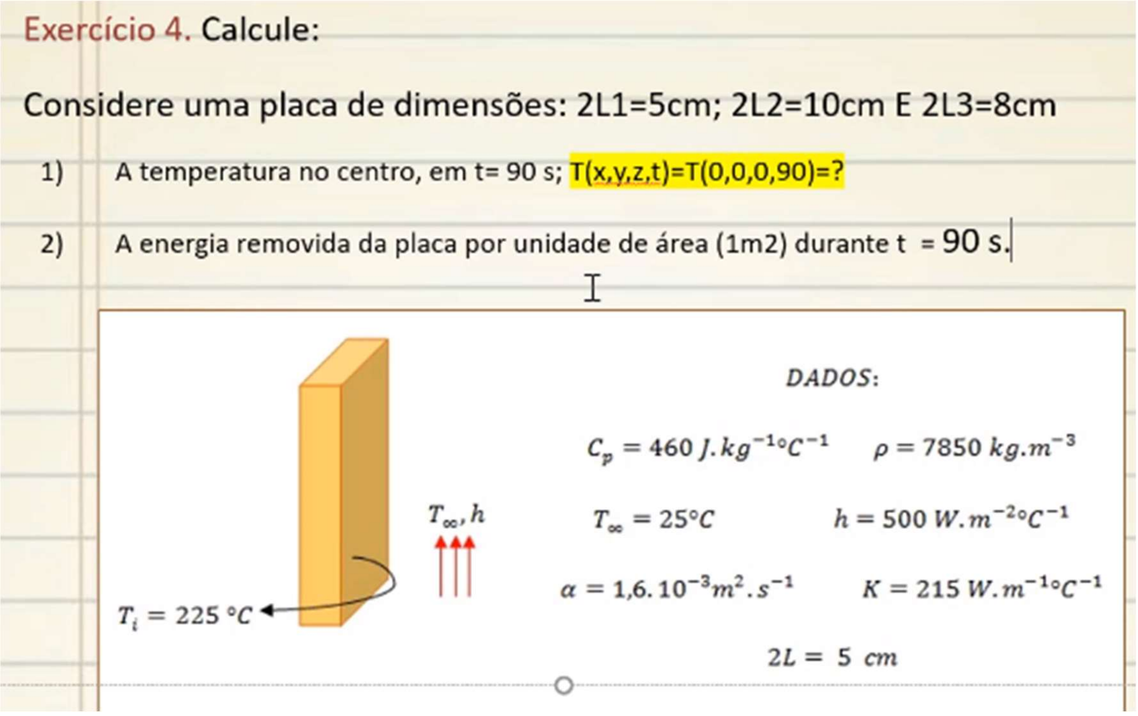

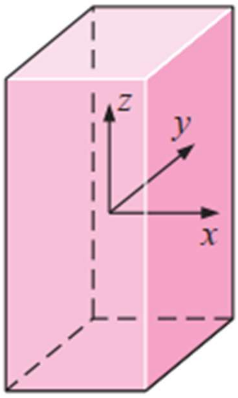

$\theta(x,y,z,t) =$
$\theta_{wall}(x,t)\,\theta_{wall}(y,t)\,\theta_{wall}(z,t)$

Rectangular parallelepiped

1º

$$2L_1 = 5cm$$

$$\frac{1}{Bi} = \frac{k}{hL} = \frac{215\ W.m^{-1}.ºC^{-1}}{500\ W.m^{-2}.ºC^{-1}\ .2{,}5.10^{-2}m} = 17{,}2$$

$$\tau = \frac{\alpha t}{L^2} = \frac{1{,}6.10^{-3}m^2.s^{-1}.90\ s}{(2{,}5.10^{-2}m)^2} = 230{,}4$$

Pelas cartas, $\theta_{o,1} = 0{,}001$.

2º

$$2L_2 = 10cm$$

$$\frac{1}{Bi} = \frac{k}{hL} = \frac{215\ W.m^{-1}.ºC^{-1}}{500\ W.m^{-2}.ºC^{-1}\ .5.10^{-2}m} = 8{,}6$$

$$\tau = \frac{\alpha t}{L^2} = \frac{1{,}6.10^{-3}m^2.s^{-1}.90\ s}{(5.10^{-2}m)^2} = 57{,}6$$

Pelas cartas, $\theta_{o,2} = 0{,}0017$.

3º

$$2L_3 = 8cm$$

$$\frac{1}{Bi} = \frac{k}{hL} = \frac{215\ W.m^{-1}.ºC^{-1}}{500\ W.m^{-2}.ºC^{-1}\ .4.10^{-2}m} = 10{,}75$$

$$\tau = \frac{\alpha t}{L^2} = \frac{1{,}6.10^{-3}m^2.s^{-1}.90\ s}{(4.10^{-2}m)^2} = 90$$

Pelas cartas, $\theta_{o,3} = 0{,}001$.

$$\theta_0 = \theta_{o,1}.\theta_{o,2}.\theta_{o,3}$$

$$\theta_o = 0{,}001.0{,}0017.0{,}001 = 1{,}7.10^{-9}$$

$$T(x,y,z,t) = \theta_o.(T_i - T_\infty) + T_\infty$$

$$T(x,y,z,t) = 1{,}7.10^{-9}.(225ºC - 25ºC) + 25ºC$$

$$\boldsymbol{T(x,y,z,t) = 25{,}00000034}$$

Cálculo do calor

$$\left(\frac{Q}{Q_{\max}}\right)_{\text{total, 3D}} = \left(\frac{Q}{Q_{\max}}\right)_1 + \left(\frac{Q}{Q_{\max}}\right)_2 \left[1 - \left(\frac{Q}{Q_{\max}}\right)_1\right] + \left(\frac{Q}{Q_{\max}}\right)_3 \left[1 - \left(\frac{Q}{Q_{\max}}\right)_1\right]\left[1 - \left(\frac{Q}{Q_{\max}}\right)_2\right]$$

Pela carta do calor ($Bi^2.\tau = \frac{h^2 \alpha t}{k^2} = 0{,}78$)

P/ $L_1 : Bi = 0{,}058 \ \rightarrow \ \left(\frac{Q}{Qmáx}\right)_1 = 1$

P/ $L_2 : Bi = 0{,}116 \ \rightarrow \ \left(\frac{Q}{Qmáx}\right)_2 = 0{,}93$

P/ $L_3 : Bi = 0{,}093 \ \rightarrow \ \left(\frac{Q}{Qmáx}\right)_3 = 0{,}96$

$$\left(\frac{Q}{Q_{máx}}\right)_{tota} = \left(\frac{Q}{Q_{máx}}\right)_1 + \left(\frac{Q}{Q_{máx}}\right)_2 \left[1 - \left(\frac{Q}{Q_{máx}}\right)_1\right] + \left(\frac{Q}{Q_{máx}}\right)_3 \left[1 - \left(\frac{Q}{Q_{máx}}\right)_1\right]\left[1 - \left(\frac{Q}{Q_{máx}}\right)_2\right]$$

$$\left(\frac{Q}{Q_{máx}}\right)_{total} = 1 + 0{,}93.(1-1) + 0{,}96.(1-1).(1-0{,}93)$$

$$\left(\frac{Q}{Q_{máx}}\right)_{total} = 1$$

$$Q_{máx} = m.C_p.(T_\infty - T_i)$$

$$Q_{máx} = (2{,}5.10^{-2}m.5.10^{-2}m.4.10^{-2}m.7850\ kg.m^{-3}).460\ J.kg^{-1}.ºC^{-1}.(25ºC - 225ºC)$$

$$Q_{máx} = -36110\ J$$

$$\boldsymbol{Q = Q_{máx} = -36110\ J}$$

Gráficos utilizados: