

# IEQB Ficha 1 - Resolução

## Conversão de unidades e cálculos em engenharia

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## Questão 1

$$1 \text{ P} \frac{\text{g cm}^{-1} \text{ s}^{-1}}{\text{P}} \frac{1 \text{ lbm}}{453.6 \text{ g}} \frac{30.48 \text{ cm}}{1 \text{ ft}} = \\ \cong 67.20 * 10^{-3} \text{ g lbm ft}^{-1} \text{ s}^{-1}$$

## Questão 2

$$R = 8.314 \text{ kg m}^2 \text{ s}^{-2} \text{ mol}^{-1} \text{ K}^{-1} \frac{\text{Pa}}{\text{kg m}^{-1} \text{ s}^{-2}} * \\ * \frac{9.869 * 10^{-6} \text{ atm}}{\text{Pa}} \frac{c^3}{(10^{-2})^3} \cong 82.05 \frac{\text{cm}^3 \text{ atm}}{\text{mol K}}$$

## Questão 3

$$\frac{g(\rho_L - \rho_G) D_b^3}{\sigma D_0} = 6$$

$$\Rightarrow D_b = \sqrt[3]{\frac{6 \sigma D_0}{g(\rho_L - \rho_G)}} = \sqrt[3]{\frac{6 * 70.8 \text{ dyn cm}^{-1} * 1 \text{ mm}}{32.174 \text{ ft s}^{-2} (1 \text{ g cm}^{-3} - 0.081 \text{ lbm ft}^{-3})}} = \\ = \sqrt[3]{\frac{6 * 70.8 \text{ g cm s}^{-2} \text{ cm}^{-1} * 0.1 \text{ cm}}{32.174 * 30.48 \text{ cm s}^{-2} (1 \text{ g cm}^{-3} - \frac{0.081 * 453.59237}{28316.846592} \text{ g cm}^{-3})}} = \\ = \sqrt[3]{\frac{6 * 70.8 * 0.1}{32.174 * 30.48 (1 - \frac{0.081 * 453.59237}{28316.846592})}} \text{ cm} \cong 351 * 10^{-3} \text{ cm}$$

## Questão 4

$$300 \text{ J/min} \frac{\text{hp}}{745.69987158227022 \text{ W}} \frac{\text{W}}{\text{J s}^{-1}} \frac{\text{min}}{60 \text{ s}} \cong \\ \cong 6.71 * 10^{-3} \text{ hp}$$

## Questão 7

7 - a) 134 000, 3

7 - b) 0.013 40, 4

## Questão 5

$$1 \text{ N} \frac{1 \text{ lbf}}{4.448222 \text{ N}} \cong 0.2 \text{ lbf}$$

## Questão 8

8 - a) 3

8 - b) 2

## Questão 6

6 - a)  $1.22 * 10^4$

6 - b)  $1.220 00 * 10^4$

6 - c)  $3.040 * 10^{-3}$

## Questão 9

$$D_{(m)} = 3 t_{(s)} + 4$$

9 - a) velocidade e espaço

9 - b)  $3 = \text{m s}^{-1}$ ;  $4 = \text{m}$

## Questão 10

$$N_{\text{pr}} = \frac{C_p \cdot \mu}{K} = \frac{583 \text{ J kg}^{-1} \text{ }^\circ\text{C}^{-1} 0.802 \text{ kg m}^{-1} \text{ s}^{-1}}{0.286 \text{ W m}^{-1} \text{ }^\circ\text{C}^{-1}} = \frac{583 * 0.802}{0.286} \cong 1650_{\text{sem calc}} \cong 1630_{\text{com calc}}$$

## Questão 11

$$K (\text{mol cm}^{-3} \text{ s}^{-1}) = 1.2 * 10^5 \exp(-2000/1.987 T)$$

$$\begin{aligned} \Leftrightarrow 1.2 * 10^5 \exp\left(\frac{-2000 \text{ cal mol}^{-1}}{1.987 T \text{ K}}\right) \text{ mol cm}^{-3} \text{ s}^{-1} = \\ = 1.2 * 10^5 \text{ mol cm}^{-3} \text{ s}^{-1} \exp\left(\frac{-2000 \text{ cal mol}^{-1}}{1.987 \text{ cal mol}^{-1} \text{ K}^{-1} T \text{ K}}\right) \end{aligned}$$

## Questão 12

$$\rho = 80.5 \exp(8.27 * 10^{-7} P)$$

12 - a)

$$\Leftrightarrow 80.5 \exp(8.27 * 10^{-7} P \text{ lbf/in}^2) \text{ lbm ft}^{-3} = 80.5 \text{ lbm ft}^{-3} \exp(8.27 * 10^{-7} \text{ in}^2 \text{ lbf}^{-1} P \text{ lbf in}^{-2})$$

12 - b)

$$\begin{aligned} 80.5 \text{ lbm ft}^{-3} \exp(8.27 * 10^{-7} \text{ in}^2 \text{ lbf}^{-1} 9.00 * 10^6 \text{ N m}^{-2}) = \\ = 80.5 \text{ lbm ft}^{-3} \frac{\text{g}}{0.002204622622 \text{ lbm}} \left(\frac{0.03280839895 \text{ ft}}{\text{cm}}\right)^3 * \\ * \exp\left(8.27 * 10^{-7} \text{ in}^2 \text{ lbf}^{-1} 9.00 * 10^6 \text{ N m}^{-2} \frac{0.224809 \text{ lbf}}{\text{N}} \left(\frac{\text{m}}{39.3700787402 \text{ in}}\right)^2\right) \cong 1.29 \text{ g cm}^{-3} \end{aligned}$$

12 - c)

$$\begin{aligned} \rho \text{ g cm}^{-3} = 80.5 \text{ lbm ft}^{-3} \frac{\text{g}}{0.002204622622 \text{ lbm}} \left(\frac{0.03280839895 \text{ ft}}{\text{cm}}\right)^3 * \\ * \exp\left(8.27 * 10^{-7} \text{ in}^2 \text{ lbf}^{-1} P \text{ N m}^{-2} \frac{0.224809 \text{ lbf}}{\text{N}} \left(\frac{\text{m}}{39.3700787402 \text{ in}}\right)^2\right) \cong \\ \cong \frac{80.5 * 0.03280839895^3}{0.002204622622} \text{ g cm}^{-3} * \exp\left(\frac{8.27 * 10^{-7} * 0.224809}{39.3700787402^2} \text{ m}^2 \text{ N}^{-1} P \text{ N m}^{-2}\right) \cong \\ \cong 1.29 \text{ g cm}^{-3} * \exp(120 * 10^{-12} \text{ m}^2 \text{ N}^{-1} P \text{ N m}^{-2}) \end{aligned}$$

12 - d)

Liquido, pois sua densidade varia pouco com a pressão