B1

GABARITO TURMA B → 27/11/2014

1ºQ | $Q_1 = v_1 \times A_1 = 5 \times \frac{\pi \times 0{,}04^2}{4} \Rightarrow \boxed{Q_1 \simeq 6{,}28 \times 10^{-3} \frac{m^3}{s}}$ (0,25)

$Q_{G3} = \gamma \times Q_3 \Rightarrow Q_3 = \frac{117{,}6}{1000 \times 9{,}8} \Rightarrow \boxed{Q_3 \simeq 0{,}012 \frac{m^3}{s}}$ (0,25)

$Q_2 = Q_1 + Q_3 = 6{,}28 \times 10^{-3} + 0{,}012 \Rightarrow \boxed{Q_2 \simeq 0{,}01828 \frac{m^3}{s}}$ (0,50)

$0{,}01828 = v_2 \times \frac{\pi \times 0{,}06^2}{4} \Rightarrow \boxed{v_2 \simeq 6{,}5 \, m/s}$ (0,25)

$Re_2 = \frac{v_2 \times D_2}{\gamma} = \frac{6{,}5 \times 60 \times 10^{-3}}{10^{-6}} = 390000 \therefore$ é TURBULENTO (0,25)

$v_{média} = \frac{49}{60} v_{máx} \Rightarrow v_{máx_2} = \frac{60}{49} \times 6{,}5$

$\boxed{v_{máx_2} \simeq 7{,}96 \, m/s \text{ ou } v_{máx_2} \simeq 8{,}0 \, m/s}$ (0,5)

2ºQ | $\rho_R = \frac{\rho_{alcool}}{\rho_{padrão}} \Rightarrow 0{,}8 = \frac{\rho_{alcool}}{1000} \Rightarrow \boxed{\rho_{alcool} \simeq 800 \frac{kg}{m^3}}$ (0,25)

$Q_1 = v_1 \times A_1 = 6 \times \frac{\pi \times 0{,}03^2}{4} \Rightarrow \boxed{Q_1 \simeq 4{,}24 \times 10^{-3} \frac{m^3}{s}}$ (0,25)

$Q_2 = v_2 \times A_2 = 10 \times \frac{\pi \times 0{,}03^2}{4} \Rightarrow \boxed{Q_2 \simeq 7{,}07 \times 10^{-3} \frac{m^3}{s}}$ (0,25)

$Q_3 = Q_1 + Q_2 = (4{,}24 + 7{,}07) \times 10^{-3} \Rightarrow \boxed{Q_3 \simeq 11{,}31 \times 10^{-3} \frac{m^3}{s}}$ (0,25)

$v_3 = \frac{Q_3}{A_3} = \frac{11{,}31 \times 10^{-3}}{\frac{\pi \times 0{,}04^2}{4}} \Rightarrow \boxed{v_3 \simeq 9 \, m/s}$ (0,50)

$Q_{M3} = Q_{M1} + Q_{M2} = 800 \times 4{,}24 \times 10^{-3} + 1000 \times 7{,}07 \times 10^{-3}$ (B2)

$Q_{M3} = 10{,}462 \simeq 10{,}5 \frac{kg}{s} \Rightarrow (0{,}25)$

$Q_{M3} = \rho_{mist} \times Q_3 \Rightarrow 10{,}462 = \rho_{mist} \times 11{,}31 \times 10^{-3}$

$\rho_{mistura} \simeq 925 \frac{kg}{m^3} \Rightarrow (0{,}25)$

3ª Q) a) $H_2 = z_2 + \frac{p_2}{\gamma} + \frac{v_2^2}{2g}$

$16 = 1{,}8 + 6{,}5 + \frac{v_2^2}{19{,}6} \Rightarrow v_2 = \sqrt{(16 - 1{,}8 - 6{,}5) \times 19{,}6}$

$v_2 \simeq 12{,}3 \text{ m/s} \Rightarrow (0{,}25)$ $\Rightarrow Q = v_2 \times A_2 = 12{,}3 \times \frac{\pi \times 0{,}05^2}{4}$

$Q \simeq 0{,}0241 \text{ m}^3/\text{s} \Rightarrow (0{,}25)$

b) $p_1 - p_2 = 1{,}4 \times (9800 - 13600 \cdot 9{,}8)$ (0,25)

$p_1 - p_2 = -172872 \text{ Pa}$ (0,25)

$p_2 = 6{,}5 \times 9{,}800 = 63700 \text{ Pa}$

$p_1 = 63700 - 172872 \Rightarrow p_1 = -109172 \text{ Pa} \Rightarrow (0{,}5)$

c) $H_1 + H_B = H_2$ → 1 → entrada da bomba

e 2 → saída da bomba

Não consideramos as perdas entre a entrada e saída da máquina, isto porque elas são consideradas

no rendimento da máquina: (B3)

$$V_1 = \frac{Q}{A_1} = \frac{0{,}0241}{\frac{\pi \times 0{,}06^2}{4}} \Rightarrow \boxed{V_1 \simeq 8{,}5\,m/s} \Rightarrow (0{,}5)$$

$$\frac{-109172}{9800} + \frac{8{,}5^2}{19{,}6} + H_B = \frac{63700}{9800} + \frac{12{,}3^2}{19{,}6}$$

$$H_B \simeq 14{,}22 + 11{,}14 - 3{,}69 \Rightarrow \boxed{H_B \simeq 21{,}7\,m} \Rightarrow (0{,}5)$$

$$H_0 + H_B = H_3 + H_{p_t}$$

$$0 + 21{,}7 = -7{,}2 + H_{p_t} \Rightarrow \boxed{H_{p_{total}} \simeq 28{,}9\,m} \Rightarrow (0{,}5)$$

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1 e 2 $\quad H_1 = H_3 + H_{p_{1-3}}$

Adotando o PHR no nível (1) e trabalhando na escala efetiva, temos:

$$0 = -1{,}5 + \frac{V_3^2}{19{,}6} + H_{p_{1-3}}.$$

$$Q_M = \rho \times Q \Rightarrow 150 = 1000 \times Q \Rightarrow \boxed{Q = 0{,}15\,\frac{m^3}{s}} \Rightarrow (0{,}5)$$

$$Q = V \times A \Rightarrow 0{,}15 = V_3 \times \frac{\pi \times 0{,}2^2}{4} \Rightarrow \boxed{V_3 \simeq 4{,}8\,\frac{m}{s}} \Rightarrow (0{,}5)$$

$$H_{p_{1-3}} = 1{,}5 - \frac{4{,}8^2}{19{,}6} \Rightarrow \boxed{H_{p_{1-3}} \simeq 0{,}325\,m} \Rightarrow (0{,}5)$$

B4

$$H_{p_{1-2}} = \frac{2}{3} \times H_{p_{1-3}} = \frac{2}{3} \times 0{,}325$$

$$\boxed{H_{p_{1-2}} \simeq 0{,}216\ m} \Rightarrow (0{,}5)$$

$H_1 = H_2 + H_{p_{1-2}}$ => PHR em (1) e na escala efetiva

$\boxed{v_2 = v_3 \text{ pois } A_2 = A_3}$

$$0 = 2 + \frac{p_2}{1000 \times 9{,}8} + \frac{4{,}8^2}{19{,}6} + 0{,}216$$

$$\boxed{p_2 \simeq -33236{,}8\ Pa} \Rightarrow (0{,}5)$$

$$p_{2_{abs}} = p_2 + p_{atm} = -33236{,}8 + 95200$$

$$\boxed{p_{2_{abs}} \simeq 61963{,}2\ Pa} \Rightarrow (0{,}5)$$