1º @

$[P] = L^2MT^{-3}$
$[\rho] = L^{-3}MT^0$
$[v] = L^1M^0T^{-1}$
$[A] = L^2M^0T^0$

$\Pi = L^0M^0T^0 = (L^2MT^{-3})^{a_1}(L^{-3}M)^{a_2}(LT^{-1})^{a_3}(L^2)^{a_4}$

L: $2a_1 - 3a_2 + a_3 + 2a_4 = 0$
M: $a_1 + a_2 = 0$
T: $-3a_1 + a_3 = 0$

$\begin{pmatrix} 2 & -3 & 1 & 2 \\ 1 & 1 & 0 & 0 \\ -3 & 0 & -1 & 0 \end{pmatrix}$

$h = 3 \to i = 4 - 3 = 1$

haciendo $a_1 = 1$ ⇒ $a_2 = -1$ $a_3 = -3$, $a_4 = 1$

$\Pi = CTE = K = \dfrac{P}{\rho v^3 A} \Rightarrow \boxed{P = K \rho v^3 A}$

b

MODELO	PROTOTIPO
ρ_M	$\rho_P = \rho_M$
Δ_M	$\Delta_P = 50^2 \Delta_M$
$V_M = 2V_P$	V_P
P_M	P_P

$\Pi_M = \Pi_P$ ⇒ SIMILITUD COMPLETA

$\dfrac{P_M}{\rho_M V_M^3 A_M} = \dfrac{P_P}{\rho_P V_P^3 A_P} \Rightarrow P_M = \left(\dfrac{V_M}{V_P}\right)^3 \left(\dfrac{\Delta_M}{\Delta_P}\right)^1 P_P$

$= \left|\dfrac{2V_P}{V_P}\right|^3 \left(\dfrac{\Delta_M}{50^2 \Delta_M}\right) P_P = 2^3 \cdot \dfrac{1}{50^2} 75000 = 240\,W = P_M$

2º @ $V_{F,A} = \sqrt{2gh} = \sqrt{2g\ell(1-\cos\phi)} =$

$= [2 \times 10 \times 10 (1 - 1/2)]^{1/2} = \underline{10\ m/s}$ (2,25)

Choque $\beta = cte$ ⇒ $m_A \cdot V_{F,A} = (m_A + m_B) \cdot V_F$

$\boxed{V_F = \dfrac{m_A}{m_A + m_B} \cdot V_{F,A} = \dfrac{1}{2} V_{FA} = 5\ m/s}$

(b)

$\Sigma \vec{F} = m \cdot \vec{a} \Rightarrow \Sigma F_n = m \cdot a_n$

$T - W_n = m \dfrac{V_c^2}{\ell}$

$T = m\left(g\cos\phi + \dfrac{V_c^2}{\ell}\right) = 270\left(10\cos 20 + \dfrac{36}{10}\right) = 1497\,N$

Para hallar v_c, $E_M = cte$ ⇒

$\dfrac{1}{2}(m_A + m_B) V_F^2 = (m_A + m_B)gh + \dfrac{1}{2}(m_A + m_B) V_c^2$

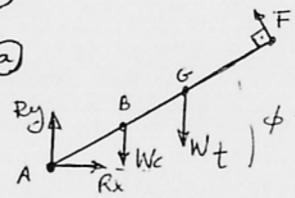
$\boxed{V_c^2 = V_F^2 - 2gh = V_F^2 - 2g\ell(1-\cos\phi) = 3.6\ m/s}$

(c)

$y = y_0 + V_{0y} t + \dfrac{1}{2} g t^2 = 15 + 1.23t - 5t^2 = 0$

$\Rightarrow \begin{cases} t = 1.86\,s \\ t < 0 \text{ (no existe)} \end{cases}$

3º @



$\Sigma \vec{M}_A = 0$

$F \cdot \ell - W_t \cdot \dfrac{\ell}{2} \cos 30° - W_c \dfrac{\overline{AB}}{2} \cos 30° = 0$

$F = \left(W_t \cdot \dfrac{\ell}{2} + W_c \cdot \dfrac{\overline{AB}}{2}\right) g \dfrac{\cos 30°}{\ell}$

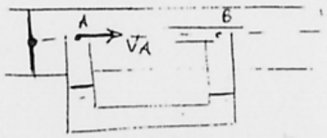
$\boxed{F = \dfrac{(5 \times 1.5 + 60 \times 0.8) \times 10 \times \sqrt{3}/2}{3} = 160.2\,N}$

b $\Sigma \vec{F}_{ext} = 0 \Rightarrow \begin{cases} R_x - F_x = 0 \\ R_y + F_y - W_c - W_t = 0 \Rightarrow R_y = -F\cos 30° + W_c + W_t \end{cases}$

$\boxed{R_x = F_x = F \cdot \operatorname{Sen} 30° = 80.1\,N}$

$\boxed{R_y = 511.2\,N}$

4º @



$Q = V_A \cdot S_A$

$\boxed{V_A = \dfrac{Q}{S_A} = \dfrac{6 \times 10^{-3}}{12 \times 10^{-4}} = 5\ m/s}$

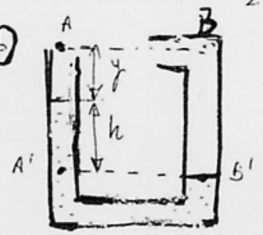
Teorema de Bernoulli

$P_A + \frac{1}{2}\rho V_A^2 + \rho g z_A = P_B + \frac{1}{2}\rho V_B^2 + \rho g z_B$ ⇒

$z_A = -2\ell$, $V_B = 0$

$P_B - P_A = \dfrac{1}{2}\rho V_A^2 = \dfrac{1}{2} \times 10^3 \times 5^2 = 12{,}500\ Pa = \underline{12.5\,kPa}$

b



$P_{A'} = P_{B'}$

$P_A + \rho_{H_2O} g y + \rho_{Hg} g h = P_B + \rho_{H_2O} g (y + h)$

$P_A + \rho_{Hg} \cdot g \cdot h = P_B + \rho_{H_2O} g h$

$\boxed{h = \dfrac{P_B - P_A}{(\rho_{Hg} - \rho_{H_2O}) g} = \dfrac{12500}{12.6 \times 10^3 \times 9.8} = 0.101\,m \simeq 10\,cm}$