FISICA 1 (PALEONTOLOGÍA)

2DO CUATRIMESTRE 2020

CLASE 4

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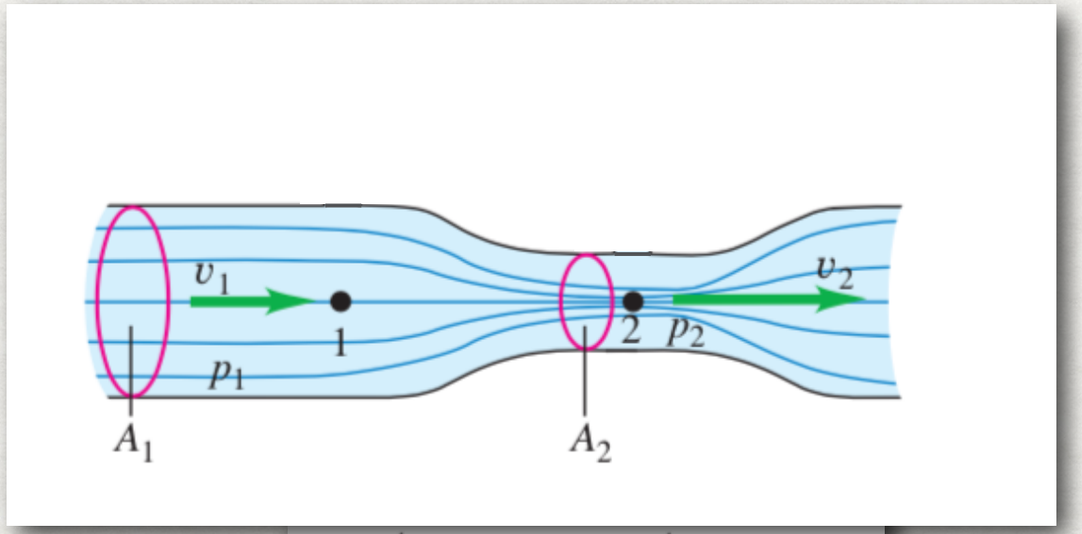
CLASE 4: HIDRODINAMICA

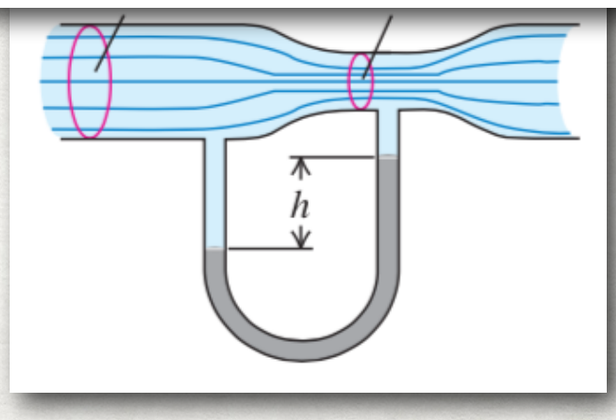
Temas: aplicaciones de Bernoulli, contador de Venturi, tubo de Pitot, sifón, ala de un avión

$$p + \frac{1}{2}\rho\, v^2 + \rho\, g\, y = cte$$

flujo estacionario, irrotacional, incompresible, no viscoso….

Contador de Venturi (1746-1822):





$$A_1 > A_2 \longrightarrow v_2 > v_1 \qquad (A_1 v_1 = A_2 v_2)$$

$$p_1 > p_2 \qquad p_1 + \frac{1}{2}\rho\, v_1^2 = p_2 + \frac{1}{2}\rho\, v_2^2$$

$$p_1 - p_2 = \frac{1}{2}\rho\,(v_2^2 - v_1^2)$$

$$\rho\, g\, h = \frac{1}{2}\rho\,(v_1^2\frac{A_1^2}{A_2^2} - v_1^2) \quad = \frac{1}{2}\rho\,(\frac{A_1^2}{A_2^2} - 1)v_1^2$$

$$v_1 = \sqrt{\frac{2\,g\,h}{(\frac{A_1^2}{A_2^2} - 1)}}$$

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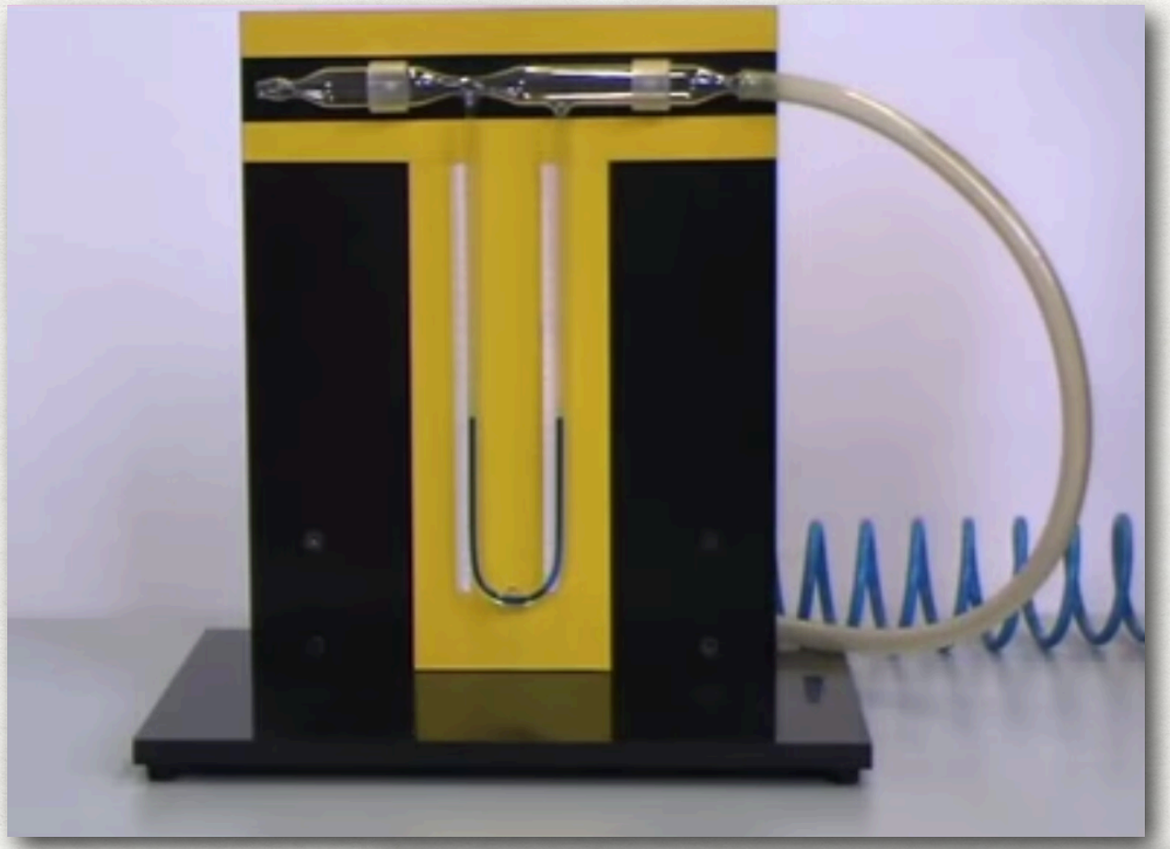
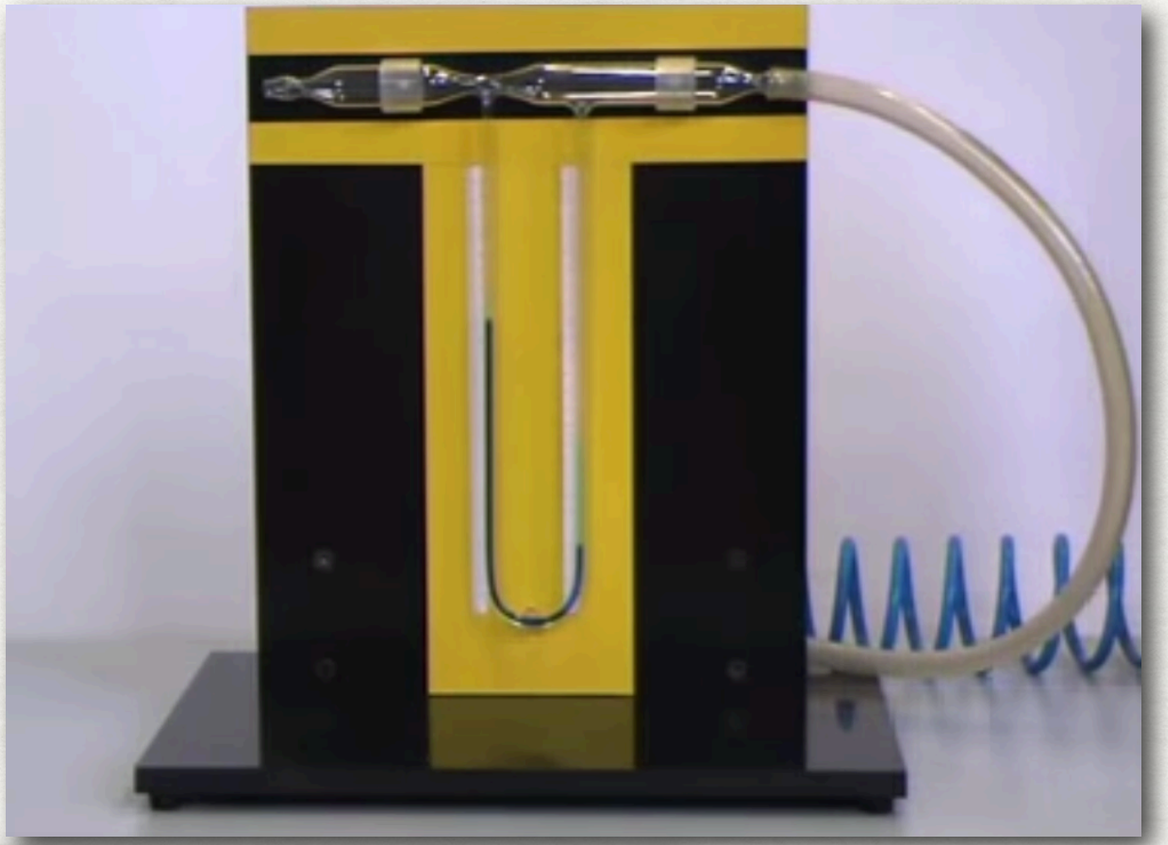
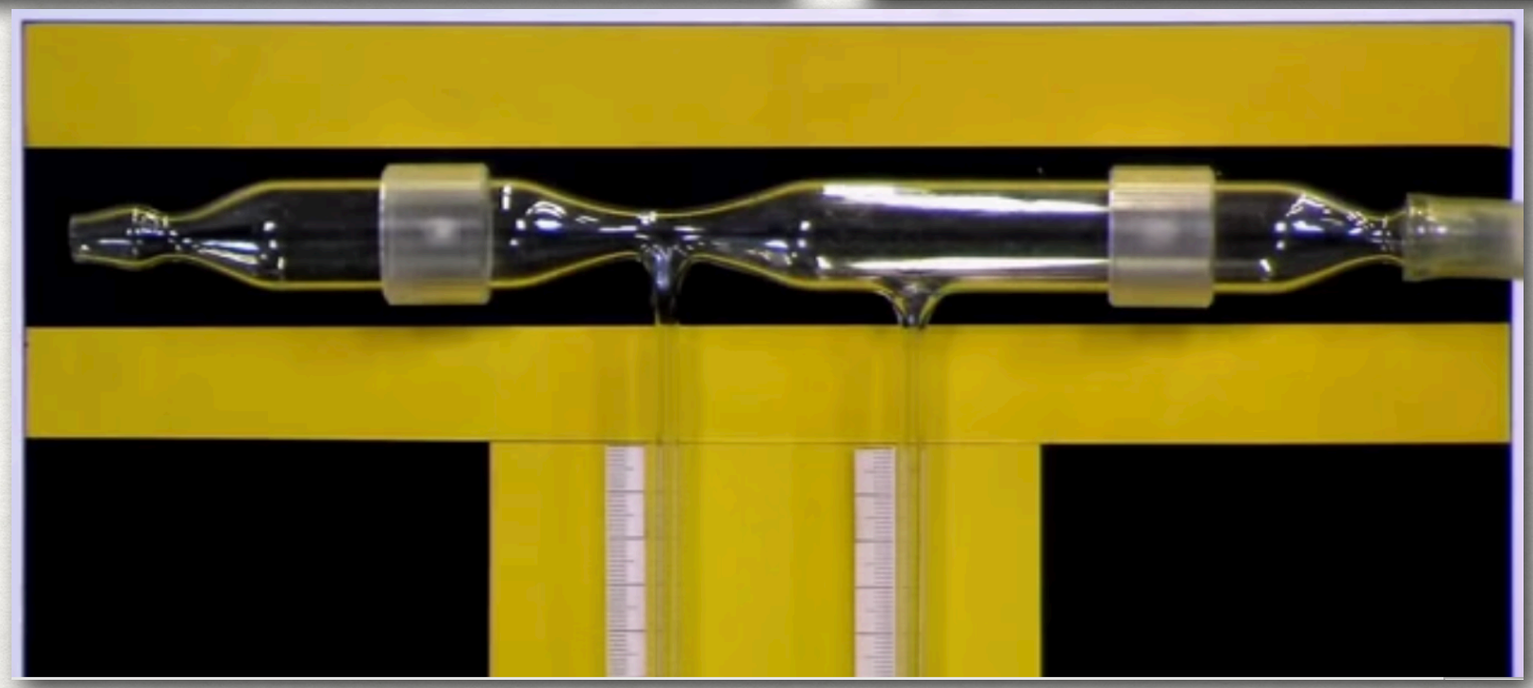
https://en.wikipedia.org/wiki/Venturi_effect







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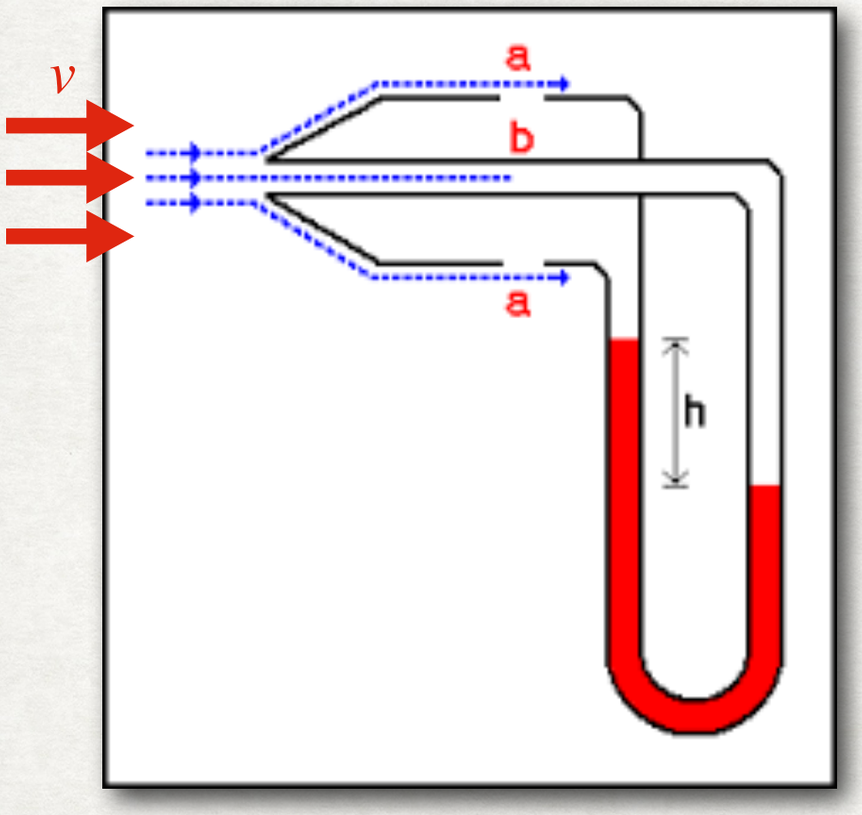
Tubo de Pitot (1695-1771):



$v_b = 0$

$$p_b = p_a + \rho\, g\, h \qquad \textit{por hidroestática}$$

$$p_b = p_a + \frac{1}{2}\,\rho_{aire} v_a^2 \qquad \textit{por Bernoulli}$$

$$p_a + \rho\, g\, h = p_a + \frac{1}{2}\,\rho_{aire} v_a^2$$

$$v \simeq v_a = \sqrt{\frac{2\,\rho\, g\, h}{\rho_{aire}}}$$

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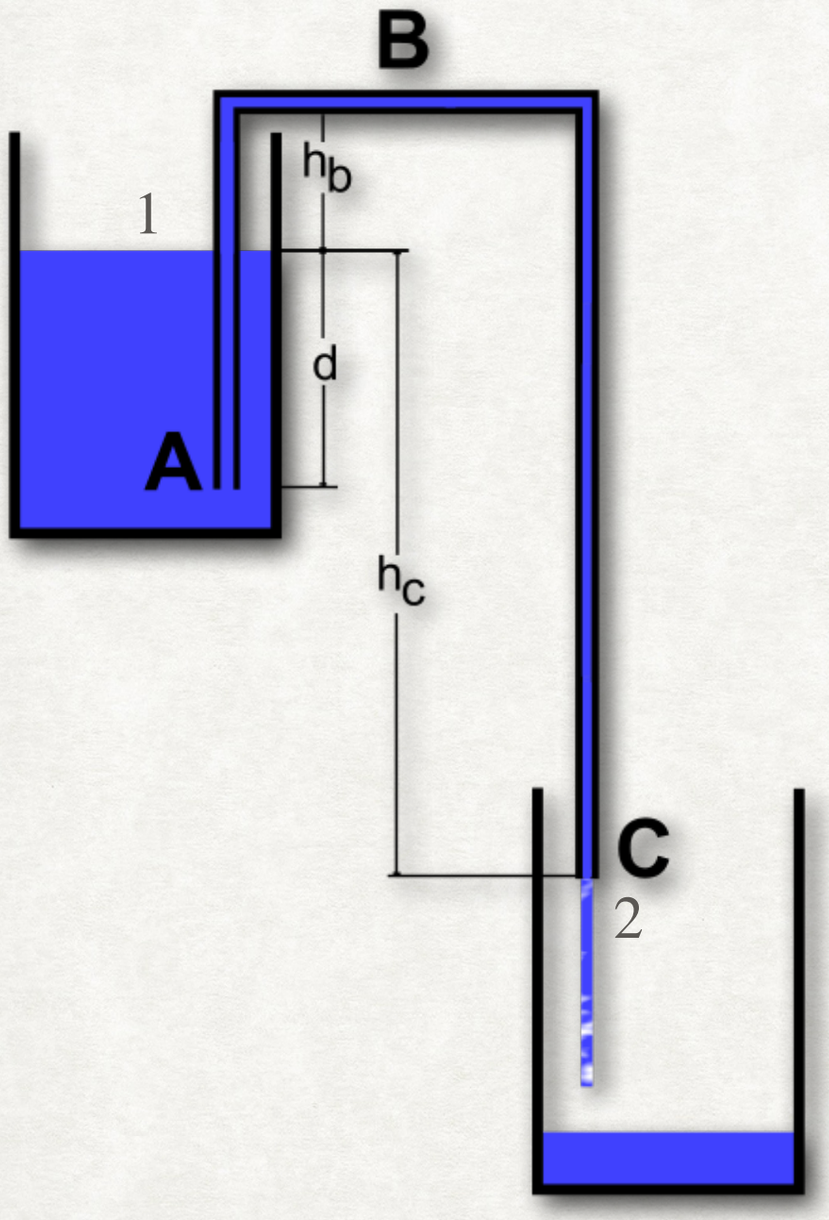
Sifón (III A.C.):



depende de h_b?

depende de d?

$$p_1 + \frac{1}{2}\rho\, v_1^2 + \rho\, g\, h_c = p_2 + \frac{1}{2}\rho\, v_2^2 + \rho\, g\, 0$$

$$p_1 = p_2 = p_{atm} \qquad v_1 \simeq 0 \qquad v_1 A = v_2 a$$

$$\frac{1}{2}\rho\, v_2^2 \frac{a^2}{A^2} + \rho\, g\, h_c = \frac{1}{2}\rho\, v_2^2$$

$$\rho\, g\, h_c = \frac{1}{2}\rho\, v_2^2 (1 - \frac{a^2}{A^2})$$

$$v_2 = \sqrt{\frac{2\, g\, h_c}{(1 - \frac{a^2}{A^2})}} = \sqrt{\frac{2\, g\, h_c\, A^2}{(A^2 - a^2)}}$$

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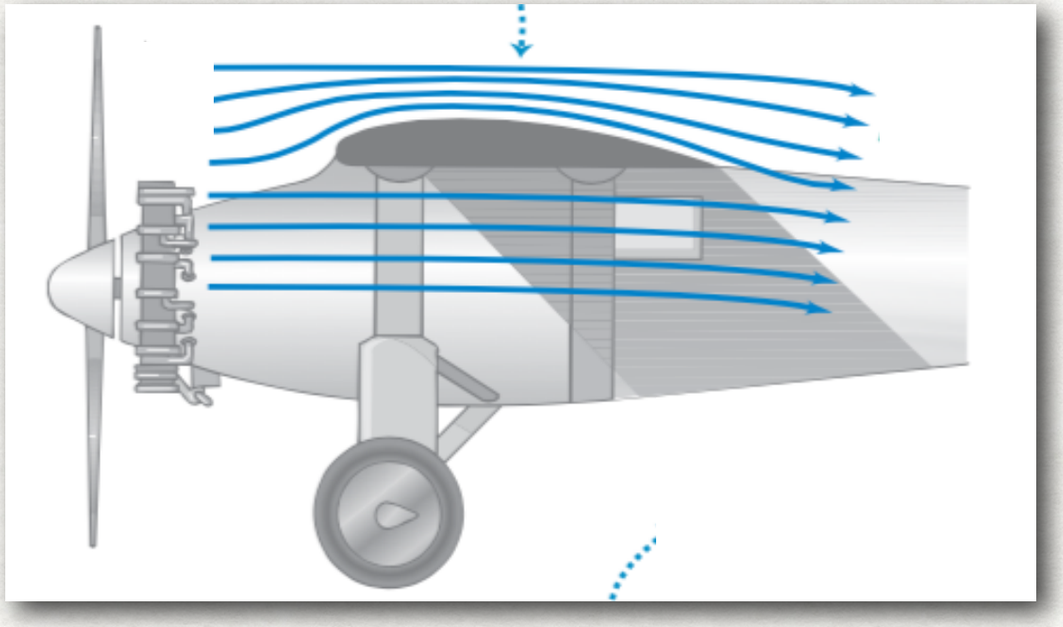
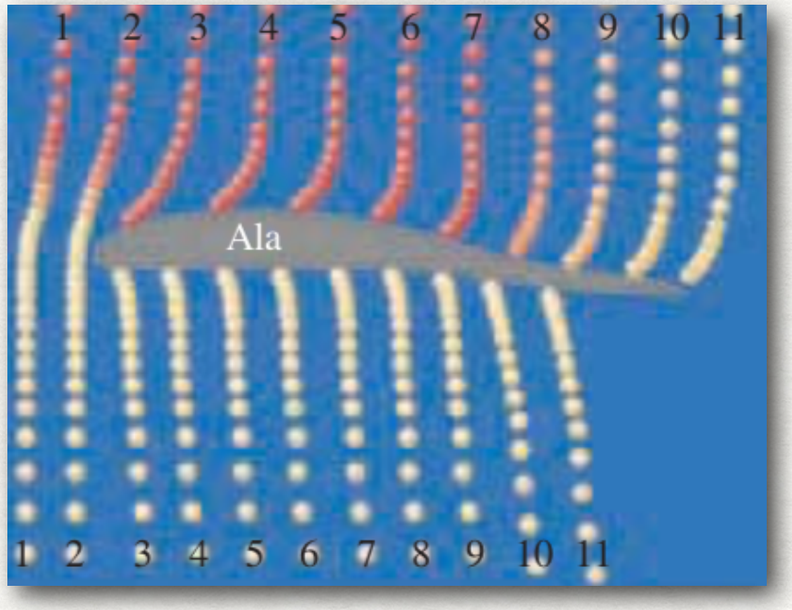
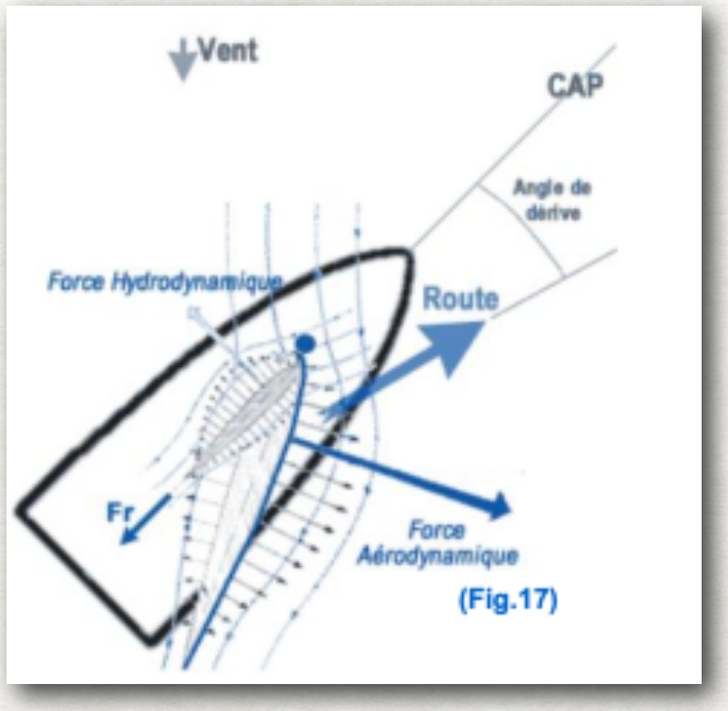
Ala de un avión:







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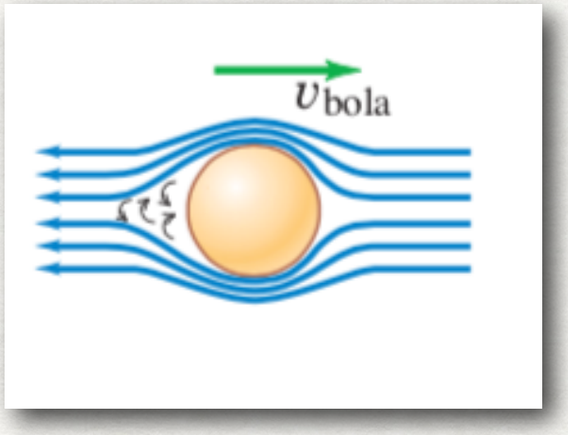
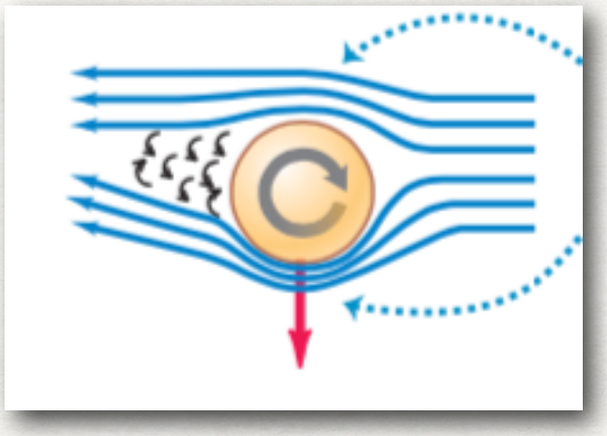
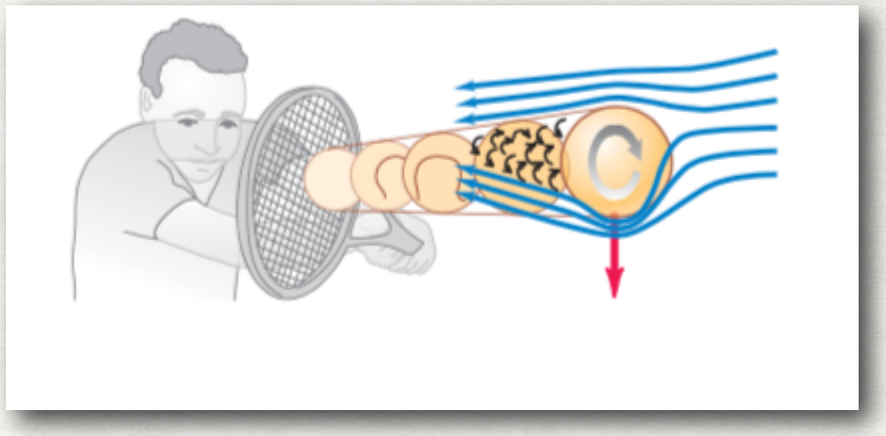
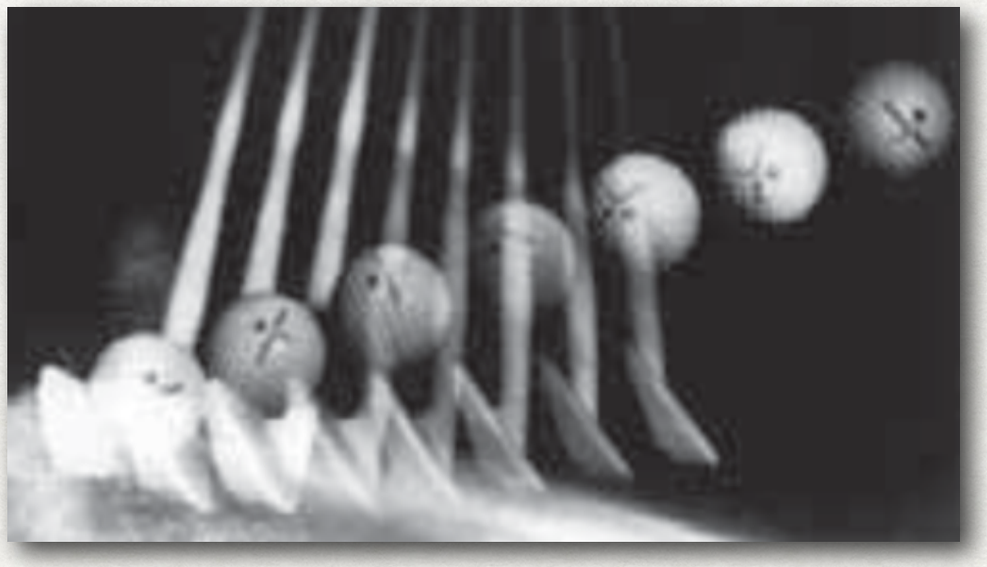
“la pelota no dobla” (Passarella 2015):









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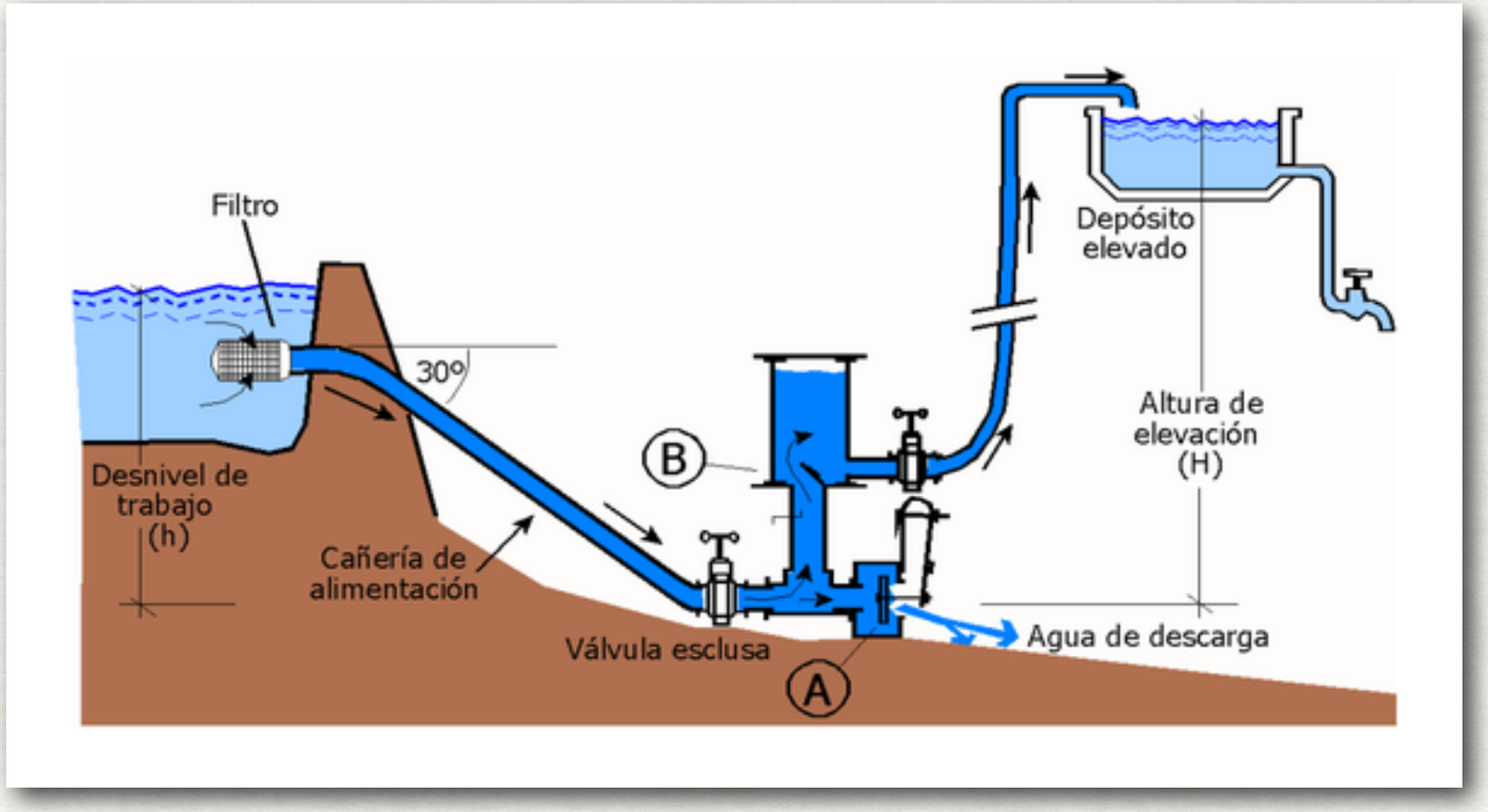
“ariete hidráulico” (John Whitehurst 1772):



$$Q_f = \frac{2\,Q_i\,h}{3\,H} = \frac{2 \cdot 300\,l/min \cdot 1m}{3 \cdot 25\,m} = 8\,l/min$$