Surface tension for distilled water in contact with air in a clean glass tube is 72.8 dynes/cm

1 dyne: imparts an acceleration of 1 cm/sec/sec to a mass of 1 gram

$$\sigma = \frac{72.8\text{dyne}}{\text{cm}}\left(\frac{0.00102\ g_f}{\text{dyne}}\ \frac{981\,\text{cm}}{\sec^2}\right) = \frac{72.8\text{g}}{\text{s}^2}$$

$$\gamma = \rho g = \frac{1\text{g}}{\text{cm}^3}\ \frac{980\text{cm}}{\text{s}^2} = \frac{980\text{g}}{\text{cm}^2 - \text{s}^2}$$

$$h_c = \frac{2\sigma}{\gamma r} = \frac{2\dfrac{72.8\text{g}}{\text{s}^2}}{\dfrac{980\text{g}}{\text{cm}^2 - \text{s}^2}\, r} \approx \frac{0.15}{r}\text{cm} \quad (\text{for } r \text{ in cm})$$

Use d_{10} to reflect the typical pore throat size

$$h_c = \frac{2\sigma}{\gamma r} \quad (\text{for}\ \ r\ \ \text{in}\ \ \text{cm})$$

For fresh water:

$$\sigma = \frac{72.8\text{dyne}}{\text{cm}}\ \frac{0.00102\ \text{g}}{\text{dyne}}\ \frac{981\,\text{cm}}{\sec 2} = \frac{72.8\text{g}}{\text{s}2}$$

$$\gamma = \rho g = \frac{1\text{g}}{\text{cm}3}\ \frac{980\text{cm}}{\text{s}2} = \frac{980\text{g}}{\text{cm}2 - \text{s}2}$$

For sand

$h_{c\text{-water}}$ = (2*72.8)/(980*0.017/2) = 17.5cm

$h_{c\text{-gas}}$ = (2*33)/(0.68*980*0.017/2) = 11.6cm

For silty-sand

$h_{c\text{-water}}$ = (2*72.8)/(980*0.0017/2) = 174cm

$h_{c\text{-gas}}$ = (2*33)/(0.68*980*0.0017/2) = 116cm

MAXIMUM HEIGHT YOU CAN RAISE WATER BY SUCTION:

AS LIMITED BY PREVAILING ATMOSPHERIC PRESSURE:

(lb/in^2 sea-level ~14.7, Denver ~12.2, Mexico City ~11.1, Mt. Everest ~4.9)

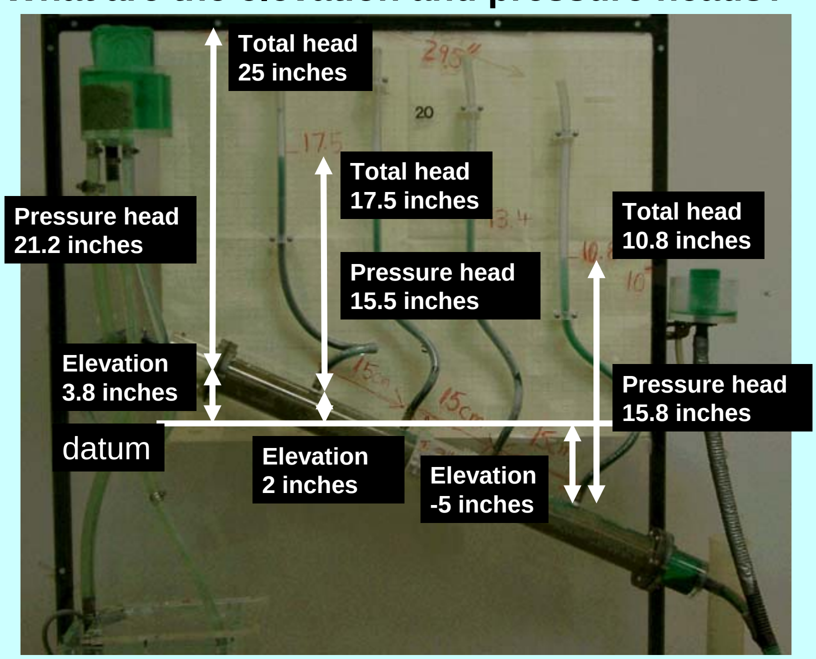
THEORETICALLY

$$H_{Pa} = \frac{P_a}{\gamma_w} = \frac{14.7\ \text{lb/in}^2}{62.4\ \text{lb/ft}^3} \times \frac{144\text{in}^2}{\text{ft}^2} = 33.92\text{ft}$$

But PRACTICALLY SPEAKING ABOUT 28ft at sea level

Denver: ~23ft
Mexico City: ~21ft
Mt. Everest: ~9ft

What are the elevation and pressure heads?



$Q = KiA$

$K = \frac{Q}{iA}$

$$K = \frac{\left[\dfrac{\text{Volume ml}\ \dfrac{1\text{cm}^3}{1\text{ml}}}{\text{time sec}}\right]}{\left[\dfrac{(h2 - h1)\text{in}}{\text{distance in}}\right]\left[\pi\left(\text{radius in}\ \dfrac{2.54\text{cm}}{\text{in}}\right)^2\right]} = \frac{\text{XX cm}}{\text{sec}}$$

Reasonable for sand?

$Q = KiA$

$K = \frac{Q}{iA}$

$$K = \frac{\left[\dfrac{120\text{ ml}\ \dfrac{1\text{cm}^3}{1\text{ml}}}{4*60\text{ sec}}\right]}{\left[\dfrac{(25 - 10)\text{in}}{29.5\text{ in}}\right]\left[\pi\left(1\text{ in}\ \dfrac{2.54\text{cm}}{\text{in}}\right)^2\right]} = \frac{0.05\text{ cm}}{\text{sec}}$$

Reasonable for sand?