$B = \frac{\mu_0 I N \mu_r}{l}$

energy of dipole is $-\vec{m}\cdot\vec{B} = E$

for water $m = \chi B \cdot l$ $\quad \vec{M} = \frac{N}{V}\vec{m}$ $\quad \vec{M} + \mu_0 \vec{H} = \mu_0 \mu_r \vec{H}$

$\boxed{M = \mu_0 \chi H}$

Water starts boiling $l = konst.$

when $p_{vapor} = p_0$

energy of interaction is thus

$\boxed{E = \mu_0 \chi \cdot H \cdot B \cdot V}$

Over pressure in the water $p = \frac{\chi H^2 \mu_0}{2}$

V of water $V = \frac{d^2\pi}{4} \cdot H$

Water will start to vaporize when ~~...~~ vapour state has less energy than water

$p_0 = n k_B T$

$Q = \Delta U + p\Delta V$

$p = p_0 + \rho g h$

$\dot{B}\, r^2 \pi = E \cdot 2\pi r$

$\frac{\dot{B} r}{2} = E_t$

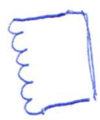
Force acting on water is calculated from the energy

$E = \frac{L I^2}{2}$

$L' = \frac{\mu_0 N_1^2 \cdot S}{l_1} + \frac{\mu_0 (N-N_1)^2 S \mu_r}{l-l_1} = \frac{\mu_0 N^2 l_1 S}{l^2} + \frac{\mu_0 \mu_r S (l-l_1)}{l^2} N^2$

$\frac{l_1}{l} \cdot N = N_1 \qquad -\frac{dE}{dl_1} = F$

Considering lonely solenoid



$\Phi = konst.$

$L' I' = L_0 I_0$

$E = \frac{L' I'^2}{2} = \frac{L_0^2 I_0^2}{2L'}$

negative sign means attractive force

$-\frac{dE}{dl_1} = +\frac{L_0^2 I_0^2}{2L'^2}\frac{dL'}{dl_1}$

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$$F = -\frac{dE}{dl_1}\Big|_{L'=L_0} = +\frac{L_0^2 I_0^2}{2L_0^4}\cdot\frac{(1-\mu_r)\mu_0 S}{l^2}\cdot N^2 = \frac{\mu_0 N^2 S(1-\mu_r) I^2}{2l^2} \quad (1)$$

$\boxed{p \cdot S = F}$

At the edge of the solonoid $B \approx B_0 \cdot \frac{1}{2}$

~~IF that force does some work, it has to be equal to energy needed for water to boil~~

$\cancel{F\,dx = p_0' dV + \underset{\approx 0}{dU}}$ $\quad \cancel{p_0' = p_0 + \rho g l}$

$\cancel{F = p_0 S}$

$\cancel{(1-\mu_r)\frac{\mu_0 N^2 S I^2}{2l^2} = p_0' S}$

$\cancel{I^2 = \frac{p_0' 2l^2}{(1-\mu_r) N^2 \mu_0}}$

$\cancel{I \approx 451\ A}$

~~We have two forces~~

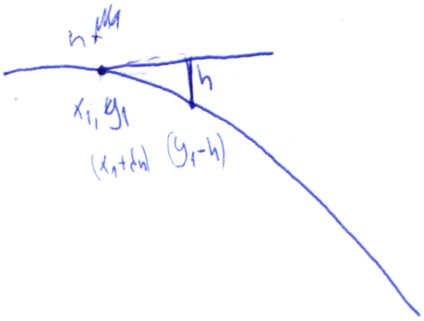
We have more forces acting on a liquid. IF the forces lifting the liquid up are stronger, liquid will go up which will create vacuum. Pressure in vacuum is zero, so p_{vapor} is equal to the outside pressure. Thus, the water starts boiling. Force acting up is the one we calculated (1). ~~The~~ forces acting downward are gravity and force from pressure.

So: $\frac{\mu_0 N^2 S (1-\mu_r) I^2}{2l^2} = mg + p_0 S$

$m = \rho V = \rho l S \cdot 2$

$I^2 = \frac{(2\rho g l + p_0) 2l^2}{\mu_0 |\chi| N^2}$

$I = 4529.8\ A$



A. both (x_1, y_1) and $(x_1+d_n ; y_1-h)$ are parts of the curve

$$-y_1 = +\left(\frac{x_1}{\lambda}\right)^{\frac{3}{2}} h$$

$$y_1 - h = -\left(\frac{x_1+d}{\lambda}\right)^{\frac{3}{2}} h \quad +$$

$$-h = \frac{-h}{\lambda^{\frac{3}{2}}}\left((x_1+d)^{\frac{3}{2}} - x_1^{\frac{3}{2}}\right)$$

$$\lambda^{\frac{3}{2}} = (x_1+d_n)^{\frac{3}{2}} - x_1^{\frac{3}{2}} \quad (1)$$

$$x_1 = d_1 + d_2 + d_3 + \dots + d_{n-1}$$

$\boxed{d_1 = \lambda}$ (from 1, using $n=1$)

$$2\lambda^{\frac{3}{2}} = (\lambda + d_2)^{\frac{3}{2}}$$

$$\left(2^{\frac{2}{3}} - 1\right)\lambda = d_2$$

$$\lambda^{\frac{3}{2}} = \left(\lambda 2^{\frac{2}{3}} + d_3\right)^{\frac{3}{2}} - 2\lambda^{\frac{3}{2}}$$

$$3\lambda^{\frac{3}{2}} = \left(2^{\frac{2}{3}}\lambda + d_3\right)^{\frac{3}{2}}$$

$$3^{\frac{2}{3}}\lambda - 2^{\frac{2}{3}}\lambda = d_3$$

$$d_n = \left(n^{\frac{2}{3}} - (n-1)^{\frac{2}{3}}\right)\cdot\lambda$$

$n \gg 1$

$$d_n \approx \left(n^{\frac{2}{3}} - n^{\frac{2}{3}}\left(1 - \frac{2}{3}\frac{1}{n}\right)\lambda\right) =$$

$$= \frac{2\lambda}{3n^{\frac{1}{3}}}$$