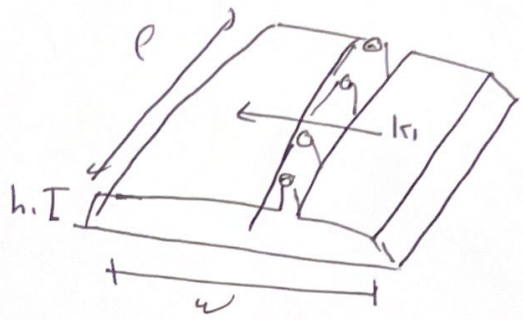
6.2.1



$I_1 = K_1 \ell$

$w >> h_1 \quad \ell >> h_1$

outside

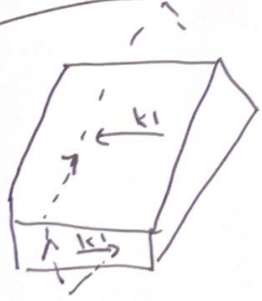
$\oint \vec{B} \cdot d\vec{\ell} = \mu_0 I_{enc}$

since $w >> h_1$, $\ell >> h_1$

$2 B_{out} \ell = \mu_0 (\ell k_1 - \ell k_1)$

$B_{out} = 0$

Inside



$\oint \vec{B} \cdot d\vec{\ell} = \mu_0 I_{enc}$

$\ell B_{in} + 0 + 0 + 0 = \mu_0 \ell k_1$

$B_{in} = \mu_0 k_1$

6.2.2

$$\Phi_m = \int \vec{B}.d\vec{s} = \int \mu_0 k.ds = \mu_0 k_1 \int ds = \mu_0 k_1 h_1 w$$

$$E_1 = -\frac{\partial \Phi_m}{\partial t} = -\mu_0 h_1 w \frac{\partial k_1}{\partial t} \Rightarrow 1$$

$$E_1 = -L_1 \frac{\partial I_1}{\partial t} = -L_1 \rho \frac{\partial k_1}{\partial t} \Rightarrow 2$$

From 1 and 2

$$+\mu_0 h_1 w \frac{\partial k_1}{\partial t} = +L_1 \rho \frac{\partial k_1}{\partial t} \Rightarrow \boxed{L_1 = \frac{\mu_0 h_1 w}{\rho}}$$

6.2.3

Method 1

$$L = \frac{1}{I}\int \vec{B}.d\vec{s} = \frac{1}{k_1 \rho}\int \mu_0 k_1 ds = \frac{\mu_0}{\rho}\int ds = \boxed{\frac{\mu_0 h_1 w}{\rho}}$$

Method 2

$$\mu_H = \int_v \vec{H}.d\vec{B}\,dv \quad \longleftarrow \quad \because B = \mu_0 H \qquad H = k_1$$

$$\mu_H = \mu_0 \int H\,dH\,dv = \mu_0 \int \frac{H^2}{2} dv = \frac{1}{2}\mu_0 k_1^2 \int dv = \frac{1}{2}\mu_0 k_1^2 h_1 \rho w$$

$$\mu_H = \frac{1}{2} L I^2 = \frac{1}{2}\mu_0 k_1^2 h_1 \rho w$$

$$L \rho^2 k_1^2 = \mu_0 k_1^2 h_1 \rho w$$

$$\boxed{L = \frac{\mu_0 w h_1}{\rho}}$$