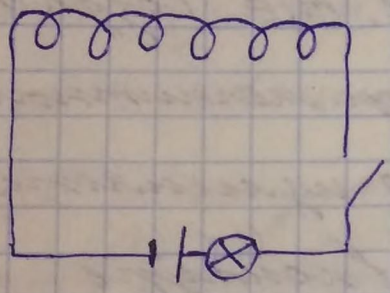
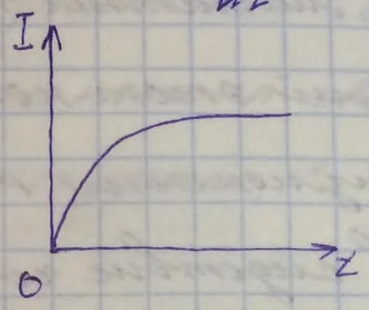
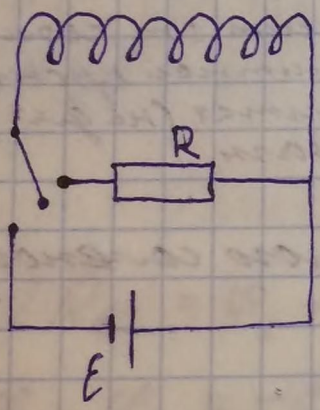
$$\mathcal{E}_c = -\frac{d\Phi}{dt} = -\frac{d(LI)}{dt} = -I\frac{dL}{dt} - L\frac{dI}{dt}$$

при $L = const$, $\mathcal{E}_c = -L\frac{dI}{dt}$





§16. Энергия магнитного поля



$$dA = \mathcal{E}_c \cdot I\,dt = -\frac{d\Phi}{dt} I\,dt = -I\,d\Phi$$

$L = const$; $\Phi = LI$; $d\Phi = L\,dI$

$$dA = -LI\,dI$$

$$A = -\int_I^0 LI\,dI = -L\int_I^0 I\,dI = \frac{LI^2}{2}$$

$$W = \frac{LI^2}{2}$$

Для бесконечно длинного соленоида:

$$L = \mu_0 \mu n^2 V \quad , \quad H = nI \Rightarrow I = \frac{H}{n}$$

$$W = \frac{\mu_0 \mu n^2 V H^2}{2n^2} = \frac{\mu_0 \mu H^2 V}{2}$$

w - объёмная плотность энергии

$$w = \frac{W}{V} = \frac{\mu_0 \mu H^2}{2} = \frac{B^2}{2\mu_0 \mu} = \frac{BH}{2}$$

$$W = \int_V w\,dV = \int_V \frac{\mu_0 \mu H^2}{2} dV = \int \frac{B^2}{2\mu_0 \mu} dV = \int_V \frac{\vec{B}\vec{H}}{2} dV$$