

Self-Induction

The phenomena of production of induced emf in a circuit due to change in current flowing in its own, is called self-induction.

Coefficient of self-induction: -

The magnetic flux linked with a coil.
 $\phi = LI$

where, L = Co-efficient of self-induction
The induced emf in the coil,

$$E = -L \frac{dI}{dt}$$

SI unit of self-induction is henry (H) and its dimensional formula is $[ML^2T^{-2}A^{-2}]$
Self-inductance of a long solenoid is given by normal text.

$$L = \frac{\mu_0 N^2 A}{l} = \mu_0 n^2 Al.$$

Where, N = total number of turns in the solenoid,
 l = length of the coil, n = no. of turns in the coil

A = Area of cross-section of the coil.
If core of the solenoid is of any other magnetic material, then

$$L = \frac{\mu_0 \mu_r N^2 A}{l}$$

Self-inductance of a toroid, $L = \frac{\mu_0 N^2 A}{2\pi r}$
where r = radius of the toroid.

Energy stored in an inductor, $E = \frac{1}{2} LI^2$