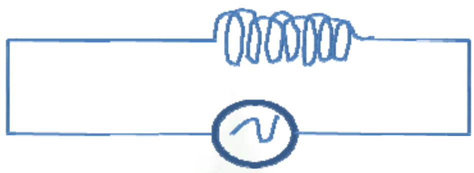
Self Induction: Let us consider a conductor kept in the form of a spherical coil. A source of varying current is connected across the coil (the spherical coil is known as solenoid).



The varying current flowing through the coil produce varying magnetic lines of force along the axis of the coil cut the plane of the coil itself and hence produced an induced emf across the coil. This is known as self-induction.

Let l = length of the coil

a = radius of the coil

N = number of turns in the coil at an instant of time t

The magnetic field produced by the current at that instant : $B = \mu_0 \frac{Ni}{l}$

The flux through the coil at the instant t

$$\phi = \vec{B}.\vec{A} = BA\cos 0 = BA$$

$$\phi = \mu_0 \frac{Ni}{l}\pi a^2 \rightarrow (1)$$

Since the flux is varying the induced emf across the coil at an instant t

$$e = -N\frac{d\phi}{dt} \text{ (from Faradays laws of electromagnetic induction)}$$

Using equation(1) : $e = -N\frac{\mu_0 N\pi a^2}{l}\frac{di}{dt}$

Putting $\frac{\mu_0 \pi N^2 a^2}{l} = L$ = Constant of the coil = Coefficient of self induction

$$e = -L\frac{di}{dt} \quad \left\{ L = \frac{Henry}{m}\frac{m^2}{m} = Henry \right.$$