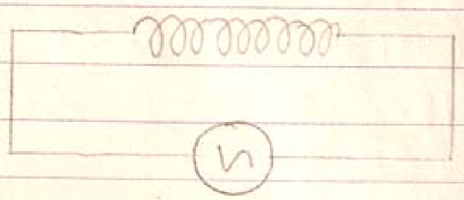
(2). A.C through a pure Inductance:



By a pure Inductance we mean that the Ohmic resistance of the coil is negligible.

Given: $e = E_p \sin\omega t$ — (1) The instantaneous applied e.m.f.

L = Self-inductance of the coil.

i = Current flowing through the coil at the instant t.

∴ The e.m.f eq^n of the circuit at the instant t:

$$L\frac{di}{dt} = e = E_p \sin\omega t$$

$$di = \frac{E_p}{L}\sin\omega t \, dt$$

Integrating both sides: $i = \frac{E_p}{L}\left[\frac{-\cos\omega t}{\omega}\right]$

$$i = \frac{E_p}{\omega L}\left[-\sin\left(\pi/2 - \omega t\right)\right] = \frac{E_p}{\omega L}\sin(\omega t - \pi/2)$$

$$i = \frac{E_p}{\omega L}\sin(\omega t - \pi/2) \quad \text{— (2)}$$

when $\sin(\omega t - \pi/2) = 1 = \max^m$ $i = I_p = \max^m$

from (2): $I_p = \frac{E_p}{\omega L}$ — (3)

putting (3) in (2):

$$i = I_p \sin(\omega t - \pi/2) \quad \text{— (4)}$$

Comparing eqns ① and ④ we find that the P.d across the pure inductance leads the current by a phase angle $\pi/2$

The resistance offered by an inductance to the flow of A.C is known as <u>Inductive Reactance</u>

<u>Inductive Reactance</u> $X_L = \dfrac{E_P}{I_P} = \omega L$ from ③

$= 2\pi f L.$