2) Capacitive Reactance :- If capacitance offered the resistance in the path of A.C then it is known as Capacitive Reactance. It is denoted by X_C.

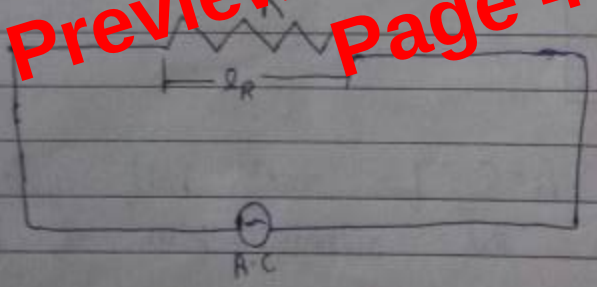
* Impedance :- Total resistance offered by inductance, resistance and capacitance is known as Impedance and it is denoted by Z.

$$Z = \frac{V}{I}$$

* Admitance :- Reciprocal of Impedance is known as Admitance. It is denoted by A.

$$A = \frac{1}{Z} \rightarrow \text{Impedance}$$

* Different types of A.C circuit :- (1) When circuit containing ohmic resistance :-

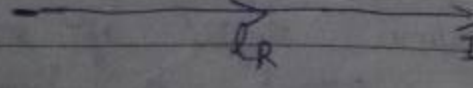


If $I = I_0 \sin \omega t$ A.C

Then Potential difference is

$e_R = e_0 \sin \omega t \angle 1 = IR$

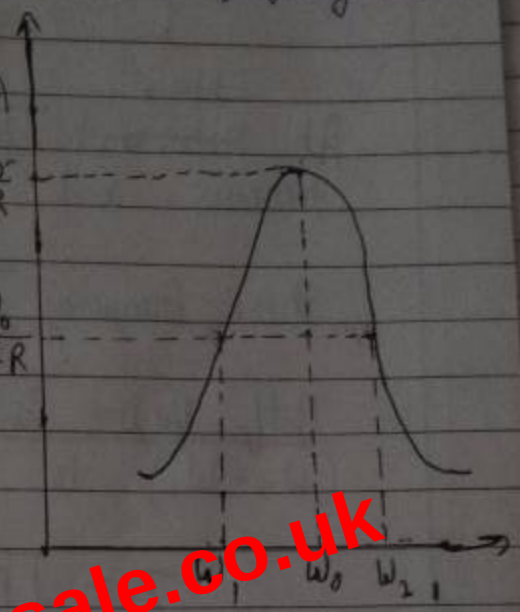
Vector representation



$$f_0 = \frac{1}{2\pi\sqrt{LC}} \quad \text{or} \quad \omega_0 = \frac{1}{\sqrt{LC}}$$

* **Quality or Q-Factor :-** The ratio of resonant frequency to the bandwidth is known as Q-factor. Sharpness of Resonance is measured by unit less and dimensionless quality factor

$$Q = \frac{\omega_0}{2\Delta\omega}$$



$\omega_0 \rightarrow$ Resonant frequency
$\Delta\omega \rightarrow$ bandwidth

Experiment:

Impedance of L-R circuit

$$Z = \sqrt{R^2 + X^2}$$

$$\therefore X^2 = (X_L - X_C)^2$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

At resonant condition

$$X_L = X_C$$

So $Z = R$

and Resonant current $I_0 = \frac{V_0}{R}$

$$X_L = \omega L \quad , \quad X_C = \frac{1}{\omega C}$$

Q = Voltage across inductor / Voltage in resonance

$$Q = \frac{V_L}{V_{reso.}} = \frac{I \cdot X_L}{I \cdot Z_{min.}}$$

$$Q = \frac{X_L}{R} \quad [Z_{min} = R]$$

$$\boxed{Q = \frac{\omega_0 L}{R}}$$

Q = Voltage across capacitor / Voltage in resonance

$$Q = \frac{V_C}{V_{reson}} = \frac{I \cdot X_C}{I \cdot Z_{min.}}$$

$$Q = \frac{1}{\omega_0 C R} \quad [Z_{min} = R]$$

$$\boxed{Q = \frac{\sqrt{LC}}{CR}}$$

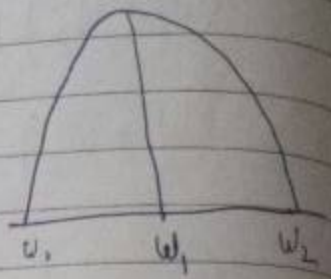
$$Q = \frac{\sqrt{L}}{\sqrt{C}\,R} = \frac{1}{R}\sqrt{\frac{L}{C}}$$

$$\therefore (\omega_2 - \omega_1)[L + L] = 2R$$

$$(\omega_2 - \omega_1) = \frac{R}{L}$$

$$Q\text{-factor} = \frac{\omega_0}{2\Delta\omega}$$

$$Q = \frac{\omega_0}{2(\omega_2 - \omega_1)}$$



$$Q = \frac{\omega_0 L}{2R}$$

$$\omega_2 = \omega_0 + \frac{\omega_2 - \omega_1}{2} = \omega_0 + \frac{R}{2L}$$

$$\omega_1 = \omega_0 - \frac{\omega_2 - \omega_1}{2} = \omega_0 - \frac{R}{2L}$$

$$\omega_0 = \frac{1}{\sqrt{LC}}$$

$$Q = \frac{1}{2\sqrt{LC}\,R}$$

$$\boxed{Q = \frac{1}{2R}\sqrt{\frac{L}{C}}}$$

* Choke coil :- It is a device which is used to control the current without power consumption.