

CONCEPT: LRC CIRCUITS

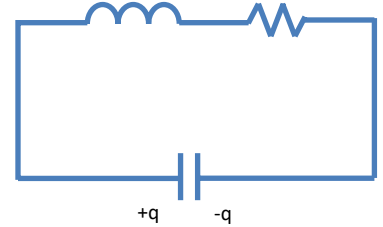
• As the name implies, an LRC circuit contains _____, _____, and _____

• In an LRC circuit, with the capacitor initially charged, we have:

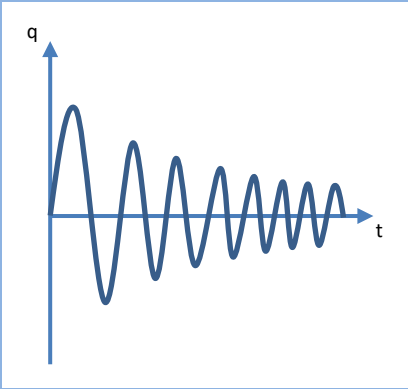
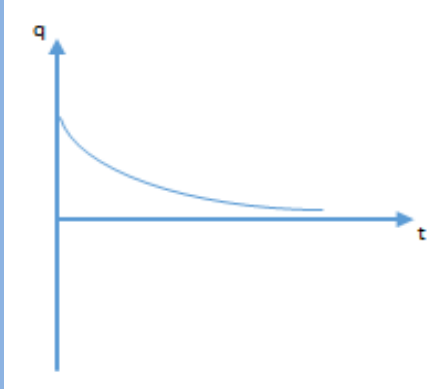
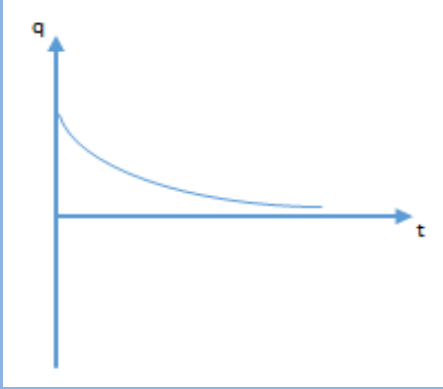
$$- \Sigma V = \text{_____} = 0$$

$$\rightarrow \text{_____} = 0$$

$$\rightarrow \text{_____} = 0$$



• There are 3 solutions to the equation above: the UNDERDAMPED, CRITICALLY DAMPED, and OVERDAMPED

UNDERDAMPED	CRITICALLY DAMPED	OVERDAMPED
$- q(t) = Qe^{-(R/2L)t} \cos(\omega' t + \phi)$  - Occurs for small R - Looks almost like an LC circuit - But R is sapping energy	$- q(t) = Qe^{-(R/2L)t}$  - Occurs when $R^2 = 4L/C$ - Looks like an RC Circuit	- No simple equation  - Occurs for large R - Looks like an RC Circuit

• The new angular frequency is

$$- \omega' = \sqrt{\frac{1}{LC} - \frac{R^2}{4L^2}}$$

EXAMPLE: AMPLITUDE DECAY IN AN LRC CIRCUIT

An LRC circuit has an inductance of 10 mH, a capacitance of 100 μF , and a resistance of 20 Ω . What type of LRC circuit is this? How long will it take for the maximum charge stored on the capacitor to drop by half?