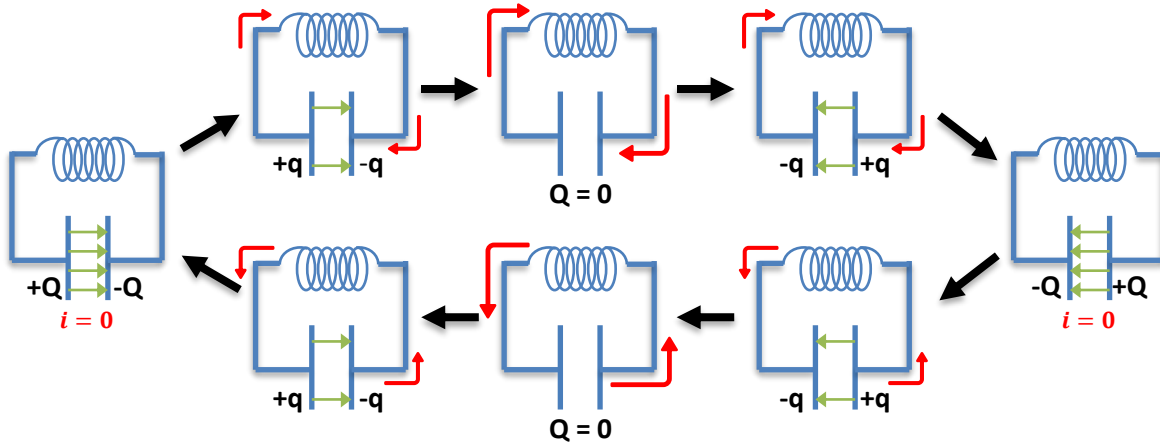## CONCEPT: LC CIRCUITS

● LC Circuits are made up of _____ and _____ and follow an 8-step cycle.

    - This system _____ and behaves similarly to **Simple Harmonic Motion** (Block + Spring)

● Because the system oscillates, the **charge** and **current** are represented by _____ functions.

    - $q(t) =$ _____

    - $i(t) =$ _____

$\omega = \sqrt{\dfrac{1}{LC}} \rightarrow$ angular frequency of oscillation

ϕ: PHASE ANGLE $\rightarrow$ determines starting point of oscillation

    - **Note:** Make sure calculators are in RADIANS mode!

EXAMPLE**:** A capacitor with capacitance 5×10^{-9}F initially has charge of magnitude 2×10^{-4}C on each plate**.** The charged capacitor is then connected to an inductor with inductance 4.0H**.** During the current oscillations that occur after the circuit is completed, what is the maximum current in the inductor?

PRACTICE: PHASE ANGLE IN LC CIRCUIT

An LC circuit with an inductor of 0.05 H and a capacitor of 35 μF begins with the current of -1A. The capacitor plates have a maximum charge of 2.65mC at any time during the oscillation. What is the phase angle of this oscillation?

EXAMPLE: OSCILLATIONS IN AN LC CIRCUIT

An LC circuit with L = 0.05 H and C = 50 mF begins with the capacitor fully charged. After 0.1s, the current is 0.2A. Under these conditions, how many seconds does it take for a fully charged plate to transfer all of its charge to the other plate?
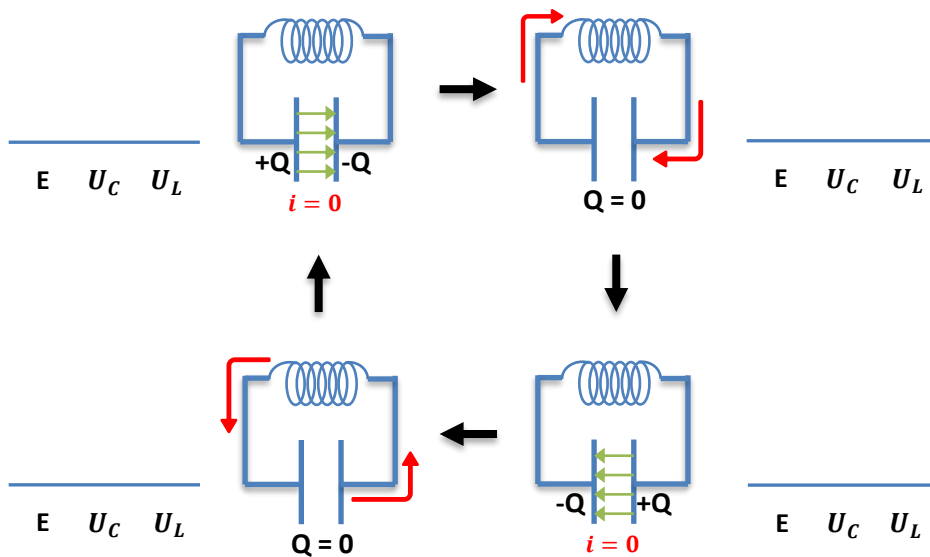
CONCEPT: ENERGY IN AN LC CIRCUIT

● Because there is <u>no resistance</u>, energy is conserved in an LC circuit:

    ▪ Energy oscillates between _____ energy (Capacitor) and _____ energy (Inductor)

● A capacitor stores ELECTRICAL ENERGY	● An inductor stores MAGNETIC ENERGY
▪ $U_C = \frac{1}{2}CV^2 = \frac{1}{2}QV = \frac{1}{2}\frac{Q^2}{C}$	▪ $U_L = $ _____

E U_C U_L +Q   -Q $i = 0$ Q = 0   E U_C U_L

E U_C U_L Q = 0   -Q   +Q $i = 0$ E U_C U_L

<u>EXAMPLE:</u> An LC circuit has an 0.1 H inductor and a 15 nF capacitor, and begins with the capacitor maximally charged with 50mC. After 0.1 s, **a)** how much energy is stored by the inductor? **b)** What is the maximum current in the circuit?

PRACTICE: LC CIRCUIT WITH UNKNOWN INDUCTOR

In an oscillating LC circuit in which the capacitance C = 4μF and the maximum voltage across the capacitor V = 1.50V, the maximum current measured across the inductor is 50mA. What is the angular frequency of this LC circuit?