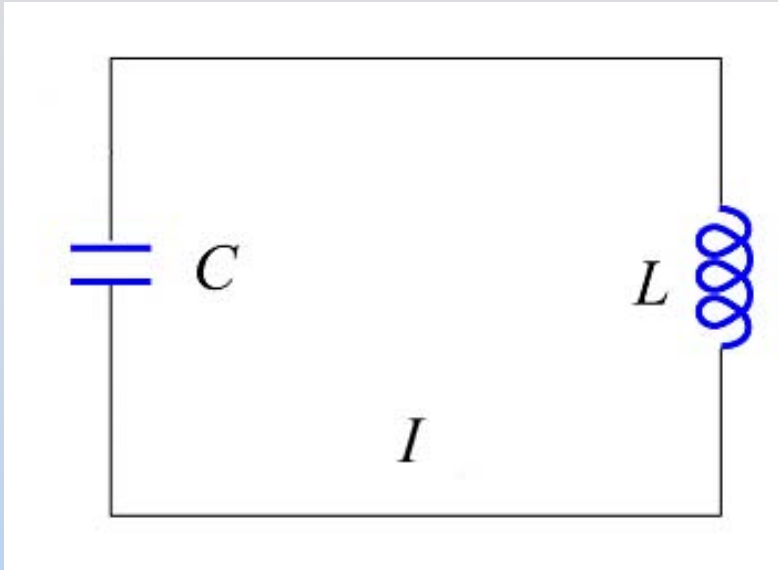
Concept Question: LC Circuit

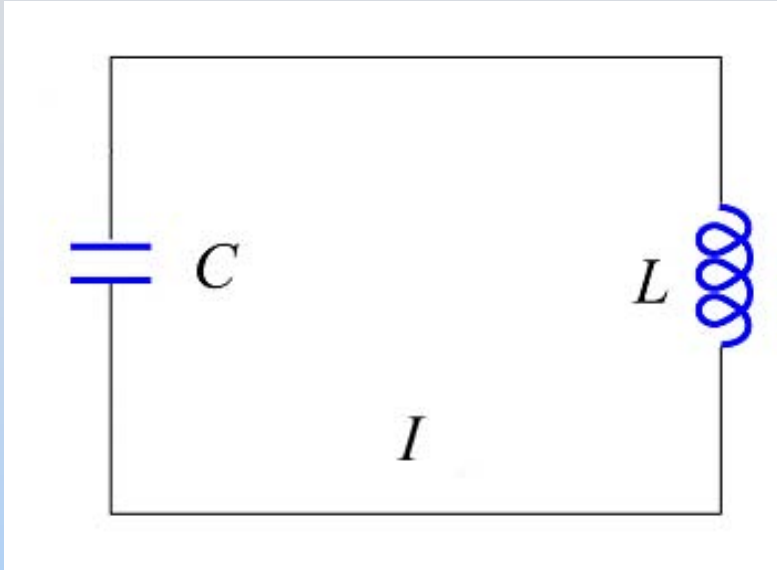
Consider the LC circuit at right. At the time shown the current has its maximum value. At this time



1. The charge on the capacitor has its maximum value
2. The magnetic field is zero
3. The electric field has its maximum value
4. The charge on the capacitor is zero
5. Don’t have a clue

Concept Question Answer: LC Circuit

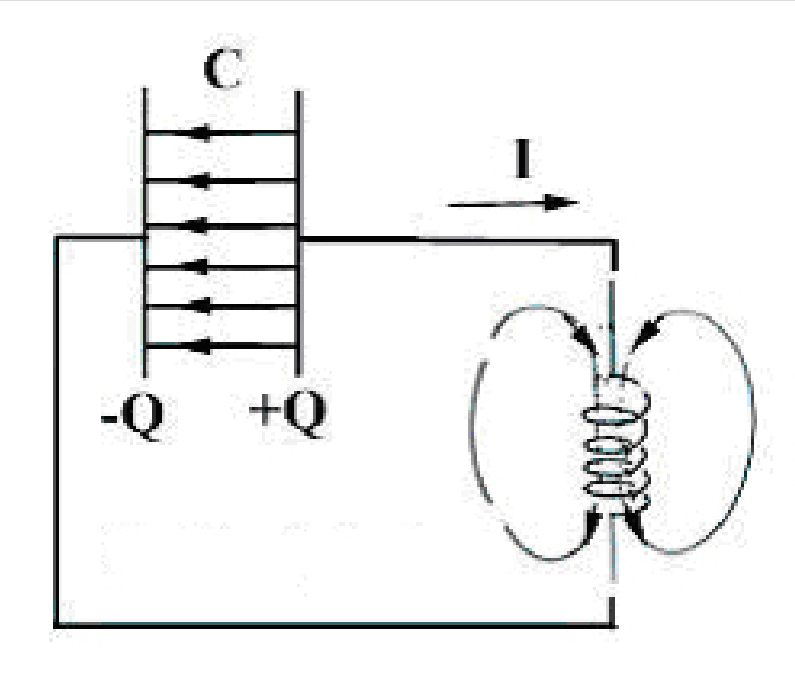
Answer: 4. The current is maximum when the charge on the capacitor is zero



Current and charge are exactly 90 degrees out of phase in an ideal LC circuit (no resistance), so when the current is maximum the charge must be identically zero.

Concept Question: LC Circuit

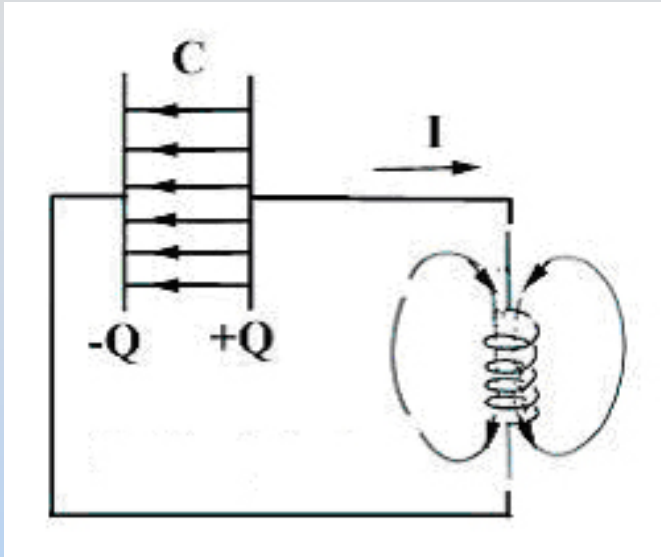
In the LC circuit at right the current is in the direction shown and the charges on the capacitor have the signs shown. At this time,



1. I is increasing and Q is increasing
2. I is increasing and Q is decreasing
3. I is decreasing and Q is increasing
4. I is decreasing and Q is decreasing
5. Don’t have a clue

Concept Question Answer: LC Circuit

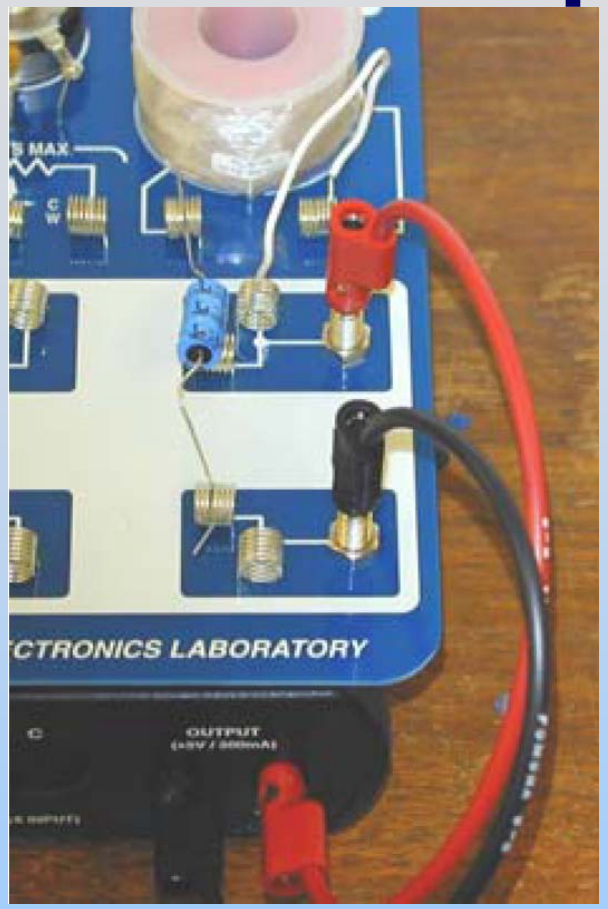
Answer: 2. I is increasing;
Q is decreasing



With current in the direction shown, the capacitor is discharging (Q is decreasing).

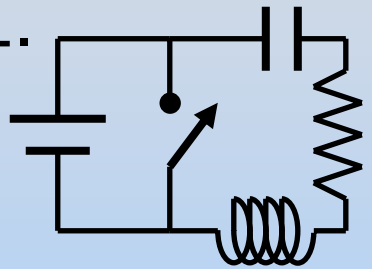
But since Q on the right plate is positive, I must be increasing. The positive charge *wants* to flow, and the current will increase until the charge on the capacitor changes sign. That is, we are in the first quarter period of the discharge of the capacitor, when Q is decreasing and positive and I is increasing and positive.

Concept Question: Expt. 8

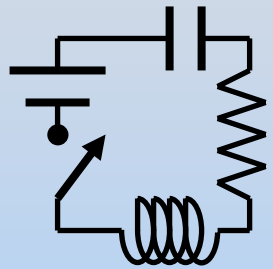


In today's lab the battery turns on and off. Which circuit diagram is most representative of our circuit?

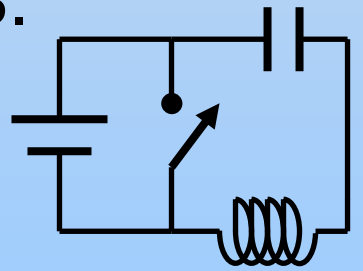
1.



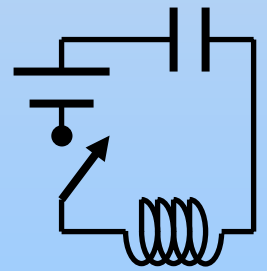
2.



3.



4.



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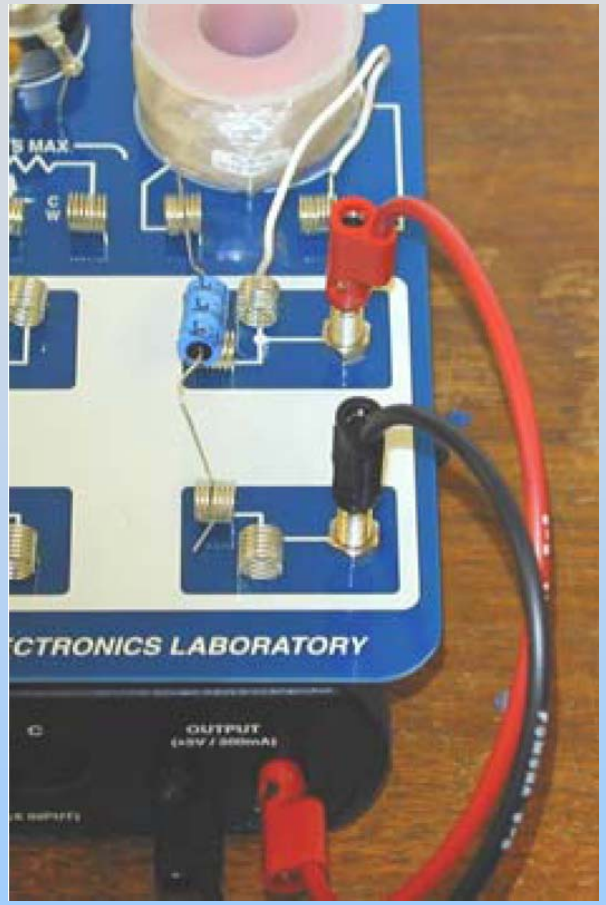
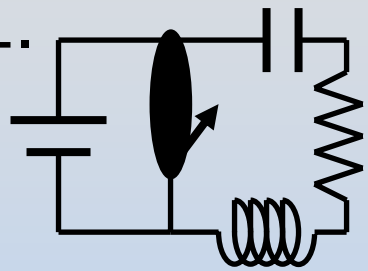
Concept Question Answer: Expt. 8



Answer: 1.

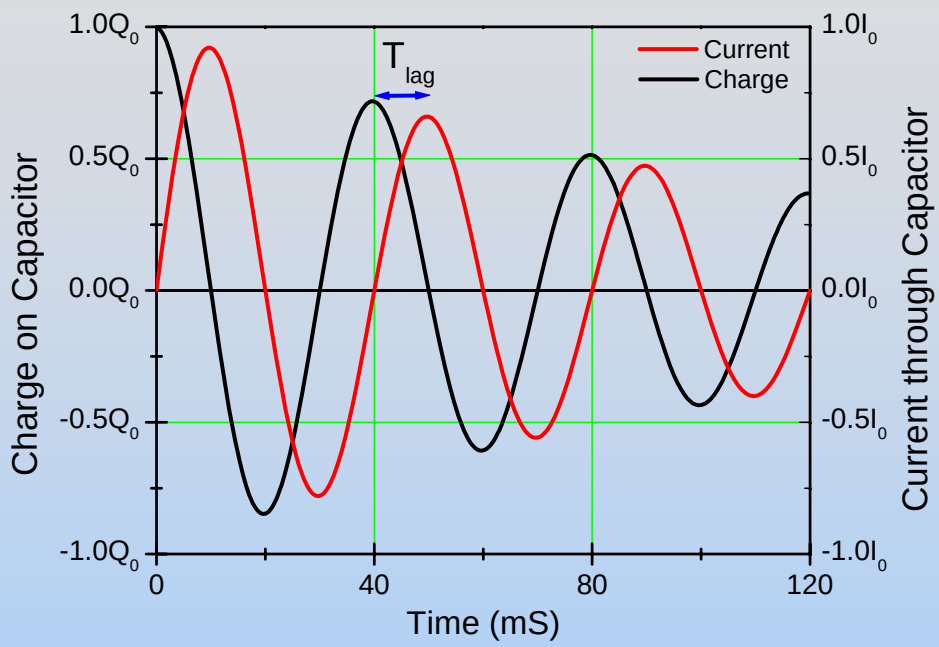


There is resistance in the circuit (in our non-ideal inductor).

The battery switching off doesn't break the circuit but allows it to ring down

Concept Question: LC Circuit

The plot shows the charge on a capacitor (black curve) and the current through it (red curve) after you turn off the power supply. If you put a core into the inductor what will happen to the time T_{Lag}?

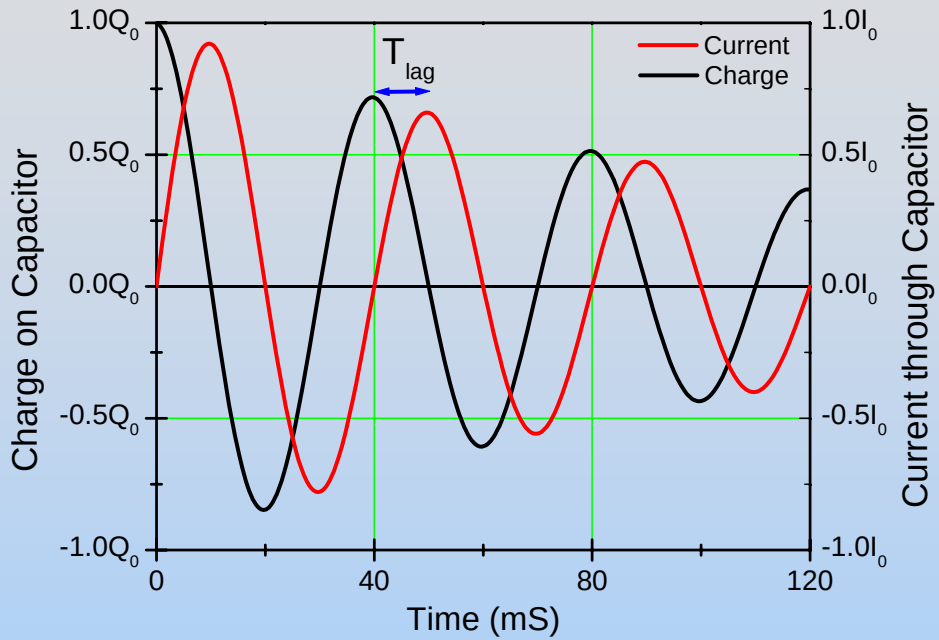


1. It will increase
2. It will decrease
3. It will stay the same
4. I don't know

Concept Question Answer: LC Circuit

Answer:

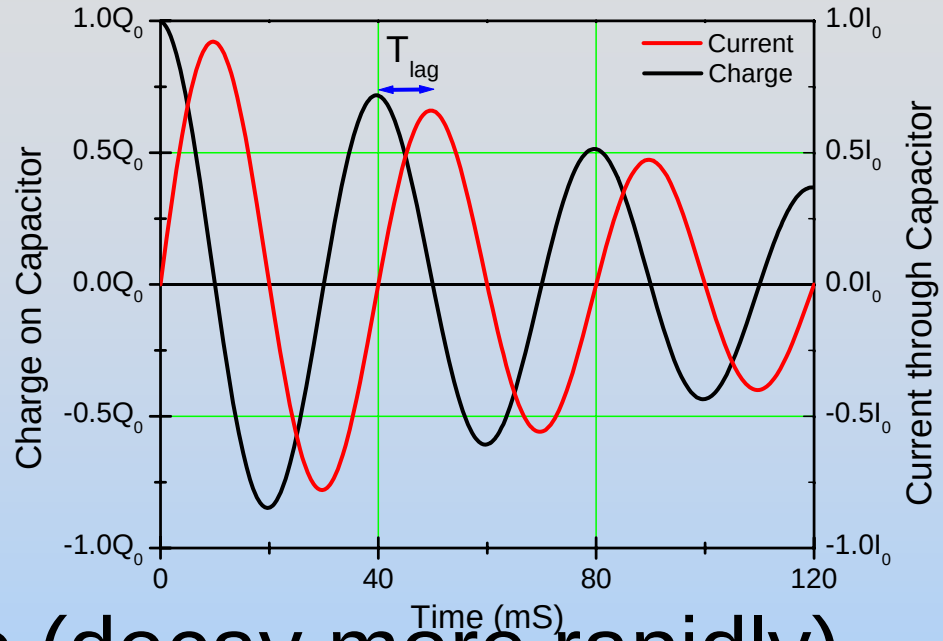
1. T_{Lag} will increase



Putting in a core increases the inductor's inductance and hence decreases the natural frequency of the circuit. Lower frequency means longer period. The phase will remain at 90º (a quarter period) so T_{Lag} will increase.

Concept Question: LC Circuit

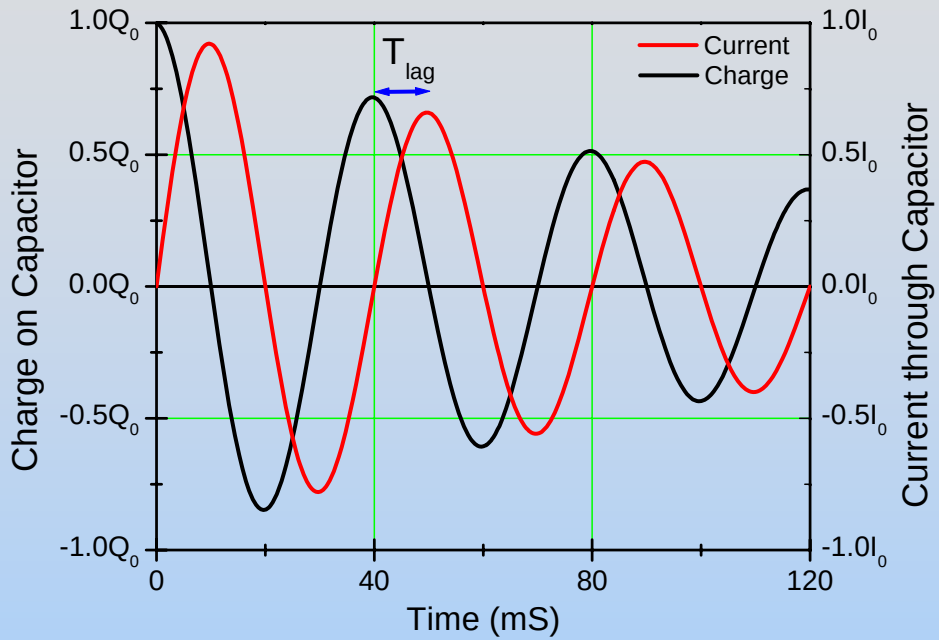
If you increase the resistance in the circuit what will happen to rate of decay of the pictured amplitudes?



1. It will increase (decay more rapidly)
2. It will decrease (decay less rapidly)
3. It will stay the same
4. I don't know

Concept Question Answer: LC Circuit

Answer: 1. It will increase (decay more rapidly)



Resistance is what dissipates power in the circuit and causes the amplitude of oscillations to decrease. Increasing the resistance makes the energy (and hence amplitude) decay more rapidly.

8.02SC Physics II: Electricity and Magnetism

Fall 2010