Worksheet: Circuits with Inductors and Capacitors in Series

Question Video

Q1: An *LC* circuit in an AM tuner (in a car stereo) uses a coil with an inductance of 2.5 mH and a variable capacitor. If the natural frequency of the circuit is to be adjustable over the range 540 to 1 600 kHz (the AM broadcast band), what range of capacitance is required?

A 3.0×10^{-11} F to 4.5×10^{-12} F

B 3.4×10^{-11} F to 4.0×10^{-11} F

C 3.5×10^{-11} F to 4.0×10^{-12} F

D 3.3×10^{-11} F to 5.0×10^{-12} F

E 3.5×10^{-11} F to 4.4×10^{-12} F

Q2: The self-inductance of an *LC* circuit is 0.20 mH. The circuit's capacitance is 5.0 pF. What is the angular frequency of the current in the circuit?

A 3.2×10^{-7} rad/s

B 4.6×10^{-7} rad/s

C 5.1×10^{-7} rad/s

D 2.6×10^{-7} rad/s

E 3.8×10^{-7} rad/s

Q3: In an oscillating *LC* circuit, the maximum charge on the capacitor is 2.0×10^{-6} C and the maximum current through the inductor is 8.0 mA.

What is the period of the oscillations?

A 7.9×10^{-4} s

B 9.2×10^{-4} s

C 8.6×10^{-4} s

D 7.3×10^{-4} s

E 6.8×10^{-4} s

How much time elapses between an instant when the capacitor is uncharged and the next instant when it is fully charged?

A 4.0×10^{-4} s

B 9.2×10^{-4} s

C 7.0×10^{-4} s

D 5.8×10^{-4} s

E 2.5×10^{-4} s

Q4: When a camera uses a flash, a fully charged capacitor discharges through an inductor. In what time must the 0.200 amperes current through a 5.00 mH inductor be switched on or off to induce a 700 V emf?

A 32.1 μs

B 98.7 μs

C 1.43 μs

D 17.3 μs

E 14.1 μs

Q5: What is the self-inductance of an LC circuit that oscillates at 90 Hz when the capacitance is 30 μF?

A 0.20 H

B 0.10 H

C 0.45 H

D 9.1 H

E 4.1 H

Q6: The self-inductance and capacitance of an oscillating LC circuit are L = 50 mH and C = 4.0 μF respectively.

What is the frequency of the oscillations?

A 120 Hz

B 210 Hz

C 560 Hz

D 360 Hz

E 360 Hz

If the maximum potential difference between the plates of the capacitor is 60 V, what is the maximum current in the circuit?

A 0.36 A

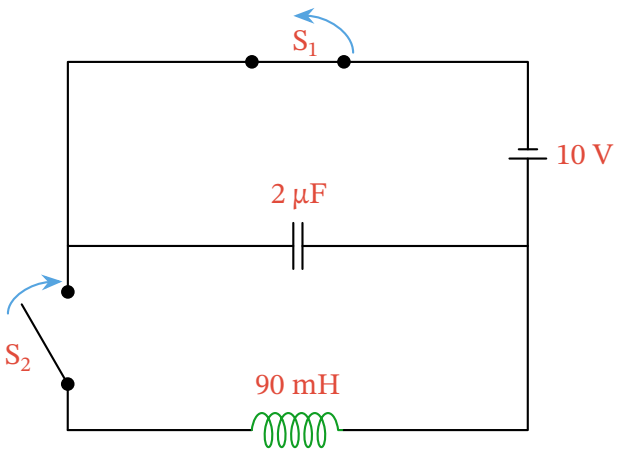
B 1.3 A

C 1.9 A

D 0.54 A

E 12 A

Q7: In the circuit shown, S_1 is opened and S_2 is closed simultaneously, resulting in a circuit that consists of just an inductor and a capacitor.



Determine the frequency of the resulting oscillations.

A 66 Hz

B 380 Hz

C 90 Hz

D 980 Hz

E 360 Hz

Determine the maximum charge on the capacitor.

A 69 μC

B 20 μC

C 150 μC

D 120 μC

E 63 μC

Determine the maximum current through the inductor.

A 77×10^{-3} A

B 47×10^{-3} A

C 98×10^{-3} A

D 88×10^{-3} A

E 69×10^{-3} A

Determine the electromagnetic energy of the oscillating circuit.

A 98 μJ

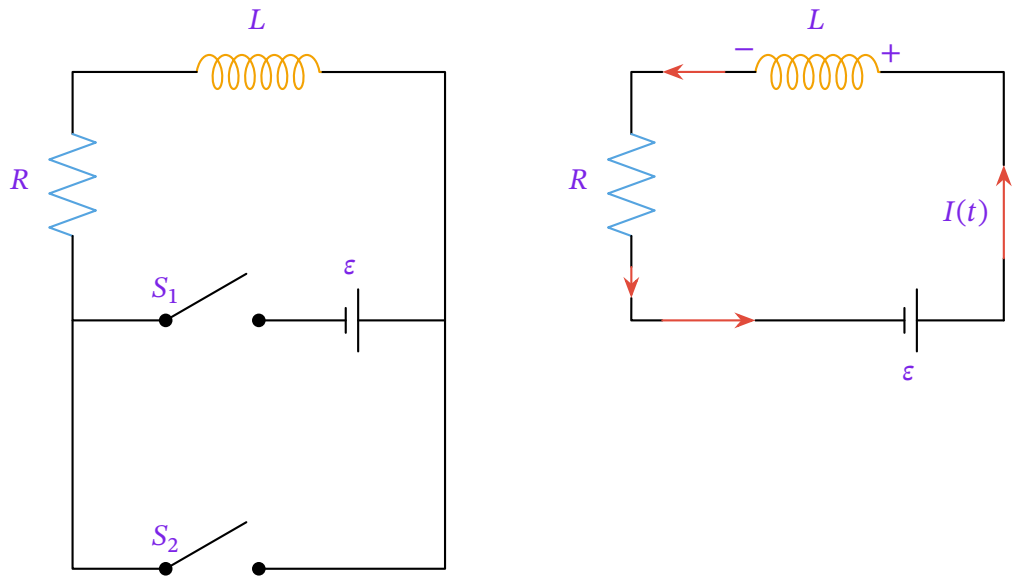
B 100 μJ

C 12 μJ

D 30 μJ

E 96 μJ

Q8: Part (a) of the diagram shows an RL circuit consisting of a resistor, an inductor, and a constant source of emf. S_1 and S_2 are switches. When S_1 is closed, the circuit is equivalent to the single-loop circuit shown in part (b) of the diagram. The value of the emf, ε, is equal to 18 V; the self-inductance, L, of the inductor is 30 mH; and the resistor has a resistance of 8.0 Ω.



Determine the inductive time constant of the circuit.

A 0.21×10^{-3} s

B 3.8×10^{-3} s

C 3.0×10^{-3} s

D 12×10^{-3} s

E 5.8×10^{-3} s

- Determine the initial current through the resistor.

A 12 A

B 0.0 A

C 5.6 A

D 1.2 A

E 3.0 A

- Determine the final current through the inductor.

A 4.0 A

B 2.3 A

C 2.6 A

D 4.3 A

E 12 A

- Determine the current through the resistor when $t = 2\tau_L$.

A 7.8 A

B 2.0 A

C 3.2 A

D 4.0 A

E 0.36 A

Determine the voltage across the inductor when $t = 3\tau_L$.

A 0.81 V

B 0.90 V

C 9.6 V

D 6.2 V

E 0.15 V