Halliday/Resnick/Walker
Fundamentals of Physics 8th edition

Classroom Response System Questions

Chapter 31 Electromagnetic Oscillations and AC Current

Reading Quiz Questions
31.2.1. Which one of the following quantities remains constant for a given LC circuit?

a) the energy stored in the capacitor

b) the energy stored in the inductor

c) the energy stored in the current flowing in the circuit

d) the sum of the energy stored in the capacitor and that in the inductor

e) the energy dissipated in the circuit
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31.3.1. The text makes a comparison between an LC circuit and a block-spring system. In this analogy, the inductance corresponds to which of the following parameters for the block-spring system?

a) mass

b) spring constant

c) velocity

d) position

e) spring potential energy
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31.3.2. Which one of the following is the correct expression for the angular frequency of oscillation for an LC circuit?

a) \( \omega = LC \)

b) \( \omega = \sqrt{LC} \)

c) \( \omega = \frac{1}{LC} \)

d) \( \omega = \frac{1}{\sqrt{LC}} \)

e) \( \omega = \frac{2\pi}{LC} \)
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31.4.1. Which one of the following statements concerning the electrical and magnetic energies stored in an LC circuit is false? Assume for the following that $\phi = 0$.

a) The maximum values of both the electric and magnetic energies is $\frac{Q^2}{2C}$.

b) The electric energy is at its minimum when the magnetic energy is zero joules.

c) At a time $t$, the sum of the electric and magnetic energies is a constant equal to $\frac{Q^2}{2C}$.

d) The electric energy varies in time with the factor, $\cos^2 \omega t$.

e) The magnetic energy is at its maximum when the electric energy is zero joules.
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31.6.1. Which of the following choices best gives the benefit(s) of using AC over using DC?

a) The length of wires is less relevant.

b) Power may be transferred over long distances using higher voltage and low current.

c) The potential difference may be varied using transformers.

d) Any potential loss in resistive elements is negligible.

e) All of the above answers are benefits of AC over DC.
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31.6.2. In an AC circuit, electrons are moving back and forth at a frequency $\omega$. The signal that the electrons receive to change direction comes from the generating station. What is the speed of that signal?

a) $v = xT$, where $x$ is the distance to a given electron and $T$ is the period of oscillation.

b) very close to the speed of light

c) faster than the speed of light

d) the drift velocity of the electrons

e) the speed of sound in the metal wire
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31.7.1. Which of the following best describes the term \textit{forced oscillations}?

a) oscillations requiring an applied force

b) oscillations that occur at a frequency other than the natural frequency of the circuit

c) oscillations that occur in the windings of the inductor within an LRC circuit

d) oscillations that occur at the natural frequency of the circuit

e) oscillations that occur within the battery of an LRC circuit
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31.8.1. An alternating current is set up in an LRC circuit. For which of the following circuit elements are the current and voltage in phase?

a) inductor only

b) resistor only

c) capacitor only

d) resistor and capacitor only

e) inductor, resistor, and capacitor
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31.8.2. An alternating current is set up in an LRC circuit. For which of the following circuit elements does the current lead the voltage by 90°?

a) inductor only
b) resistor only
c) capacitor only
d) resistor and capacitor only
e) inductor, resistor, and capacitor
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31.8.3. An alternating current is set up in an LRC circuit. For which of the following circuit elements does the voltage lead the current by 90°?

a) inductor only

b) resistor only

c) capacitor only

d) resistor and capacitor only

e) inductor, resistor, and capacitor
31.8.3. An alternating current is set up in an LRC circuit. For which of the following circuit elements does the voltage lead the current by 90°?

a) inductor only
b) resistor only
c) capacitor only
d) resistor and capacitor only
e) inductor, resistor, and capacitor
31.8.4. What is the SI unit for capacitive reactance?

a) farad

b) mho

c) ohm

d) cordel

e) reyn
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a) farad

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**c) ohm**

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31.8.5. Which one of the following choices is not a property of a phasor?

a) angular speed
b) emf
c) length
d) projection
e) rotation angle
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31.8.6. When a capacitor is used in an alternating current circuit, the current in the capacitor is related to the voltage across the capacitor by its capacitive reactance, which depends on the capacitance of the capacitor and the frequency of the generator. Which one of the following statements correctly describes the relationship between the capacitive reactance and the frequency?

a) The capacitive reactance is directly proportional to the frequency.

b) The capacitive reactance is directly proportional to the square of the frequency.

c) The capacitive reactance is inversely proportional to the frequency.

d) The capacitive reactance is inversely proportional to the square of the frequency.

e) The capacitive reactance is directly proportional to the square root of the frequency.
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e) The capacitive reactance is directly proportional to the square root of the frequency.
31.8.7. When an inductor is used in an alternating current circuit, the current in the inductor is related to the voltage across the inductor by its inductive reactance, which depends on the inductance of the inductor and the frequency of the generator. Which one of the following statements correctly describes the relationship between the inductive reactance and the frequency?

a) The inductive reactance is directly proportional to the frequency.

b) The inductive reactance is directly proportional to the square of the frequency.

c) The inductive reactance is inversely proportional to the frequency.

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d) The inductive reactance is inversely proportional to the square of the frequency.

e) The inductive reactance is directly proportional to the square root of the frequency.
31.9.1. Which of the following phrases best describes the term *impedance*?

a) the resistance to the movement of charge carriers

b) the resistance of a capacitor

c) the resistance of an inductor

d) the internal resistance of a battery within an LRC circuit

e) the generalized expression that combines all resistances within a circuit
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31.9.2. For an RLC circuit in the limit of very high frequency, what is the effective behavior of the capacitor and the inductor in the circuit?

a) The inductor acts like a very small resistance and the capacitor acts like a very large resistance.

b) The inductor acts like a very large resistance and the capacitor acts like a very small resistance.

c) The inductor acts like a very large resistance and the capacitor acts like a very large resistance.

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d) The inductor acts like a very small resistance and the capacitor acts like a very small resistance.
31.9.3. What effect does the resistor in an RLC circuit have on the circuit’s resonant frequency?

a) The resonant frequency is determined by the inductance and the capacitance, but not the resistance.

b) Increasing the resistance increases the resonant frequency.

c) Decreasing the resistance increases the resonant frequency.

d) Increasing the resistance decreases the resonant frequency.

e) Decreasing the resistance decreases the resonant frequency.
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e) Decreasing the resistance decreases the resonant frequency.
31.9.4. Which of the following statements concerning resonance in an RLC circuit is true?

a) At the resonant frequency, the rms current is at a minimum and the rms impedance is at a maximum.

b) At the resonant frequency, the rms current is at a maximum and the rms impedance is at a minimum.

c) At the resonant frequency, the rms current is at a maximum and the rms impedance is at a maximum.

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31.10.1. Which of the following choices gives the amount of power used by a capacitor in an ac circuit?

a) $I_{\text{rms}}XC$

b) $I_{\text{rms}}XC^2$

c) $V_{\text{rms}}I_{\text{rms}}^2$

d) $V_{\text{rms}}XC$

e) The power used by the capacitor is equal to zero watts.
31.10.1. Which of the following choices gives the amount of power used by a capacitor in an ac circuit?

a) $I_{\text{rms}}X_C$

b) $I_{\text{rms}}XC^2$

c) $V_{\text{rms}}I_{\text{rms}}^2$

d) $V_{\text{rms}}XC$

e) The power used by the capacitor is equal to zero watts.
31.10.2. In a series RLC circuit, the average power is given by $P = I_{\text{rms}} V_{\text{rms}} \cos \phi$. What is the name given to the term $\cos \phi$?

a) phase factor

b) force term

c) power factor

d) energy determinator

e) rms term
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31.11.1. Which of the following is the primary benefit of impedance matching?

a) maximum transfer of energy

b) maximum resistive load

c) same time constant
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31.11.2. In a well-designed transformer with an iron core, the secondary coil has twice as many turns as the primary coil. Which one of the following statements concerning this transformer is true?

a) The flux that passes through each turn of the primary coil is twice the flux that passes through the secondary coil.

b) The effect of the iron core is to reduce the magnetic field passing through the coils.

c) The induced emf generated in the secondary coil is twice as large as that generated in the primary coil.

d) This is a step down transformer because the current in the secondary coil is less than that in the primary coil.

e) This kind of transformer is typically used between a power transmission line and a residence.
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