

TPC Basic Electricity and Electronics Practice Test (Sample)

Study Guide



Everything you need from our exam experts!

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Questions

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- 1. What is a diode?**
 - A. A device that amplifies current in a circuit**
 - B. A resistor used to control voltage**
 - C. A semiconductor device that allows current to flow in one direction only**
 - D. A type of capacitor used in power supplies**
- 2. Which law states that current through a conductor between two points is directly proportional to the voltage across the two points?**
 - A. Faraday's Law**
 - B. Kirchhoff's Law**
 - C. Ohm's Law**
 - D. Newton's Law**
- 3. Which component is primarily responsible for the flow of electrons in an electrical circuit?**
 - A. Capacitor**
 - B. Inductor**
 - C. Resistor**
 - D. Diode**
- 4. What is true about static electricity?**
 - A. It moves freely in the circuit**
 - B. It does not move**
 - C. It is always negative**
 - D. It is dangerous to touch**
- 5. Which components are included in an RLC circuit?**
 - A. A resistor, a relay, and a diode**
 - B. A resistor, an inductor, and a capacitor**
 - C. A resistor, a capacitor, and a switch**
 - D. An inductor, a diode, and a capacitor**

- 6. What is inductance measured in?**
- A. Volts**
 - B. Ohms**
 - C. Coulombs**
 - D. Henry**
- 7. What is the unit of electrical resistance?**
- A. Coulomb**
 - B. Volt**
 - C. Ohm**
 - D. Watt**
- 8. What is a common application of a Schmitt trigger in digital electronics?**
- A. Frequency modulation**
 - B. Signal conditioning**
 - C. Waveform generation**
 - D. Timer circuits**
- 9. What parameter defines the frequency of an AC signal?**
- A. Volts**
 - B. Ampere**
 - C. Ohm**
 - D. Hertz (Hz)**
- 10. What type of analog component can amplify a signal?**
- A. Resistor**
 - B. Capacitor**
 - C. Diode**
 - D. Operational amplifier**

Answers

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1. C
2. C
3. D
4. B
5. B
6. D
7. C
8. B
9. D
10. D

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Explanations

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1. What is a diode?

- A. A device that amplifies current in a circuit
- B. A resistor used to control voltage
- C. A semiconductor device that allows current to flow in one direction only**
- D. A type of capacitor used in power supplies

A diode is a semiconductor device that allows current to flow in one direction only, which is essential for rectification in electronic circuits. This unidirectional behavior is attributed to the diode's structure, which consists of a p-n junction. When the anode is positive relative to the cathode, the diode becomes forward-biased, allowing current to pass through. Conversely, when reverse-biased, it blocks current flow, making diodes crucial for controlling the direction of current in circuits. This capability is vital in applications such as converting alternating current (AC) to direct current (DC), protecting circuits from reverse voltages, and managing signal flow in various electronic devices. The distinction of a diode's function is significant as it differs fundamentally from components like amplifiers, resistors, and capacitors, which serve different roles in electronic circuits.

2. Which law states that current through a conductor between two points is directly proportional to the voltage across the two points?

- A. Faraday's Law
- B. Kirchhoff's Law
- C. Ohm's Law**
- D. Newton's Law

The statement that current through a conductor between two points is directly proportional to the voltage across those two points is a description of Ohm's Law. This law establishes a fundamental relationship in electrical circuits, which can be expressed mathematically as $V = I * R$, where V is voltage, I is current, and R is resistance. According to this law, if the resistance remains constant, an increase in voltage will result in a proportional increase in current. Understanding Ohm's Law is crucial for analyzing and designing electrical circuits, as it helps predict how changes in voltage will affect current flow, which is essential for various applications in electronics and electrical engineering. This principle is foundational for both theoretical and practical aspects of electricity.

3. Which component is primarily responsible for the flow of electrons in an electrical circuit?

- A. Capacitor**
- B. Inductor**
- C. Resistor**
- D. Diode**

The component primarily responsible for the flow of electrons in an electrical circuit is the diode. A diode is a semiconductor device that allows current to flow in one direction while blocking it in the opposite direction. This property makes diodes essential for controlling and directing the flow of electrons, thereby allowing current to pass through only when the appropriate conditions are met. In practical terms, when voltage is applied in the forward direction, the diode becomes conductive, enabling the flow of electrons through the circuit. This flow is crucial for circuit functionality, particularly in applications where rectification (conversion of AC to DC) is needed. In contrast, a capacitor stores and releases electrical energy but does not directly influence the flow of electrons in the same manner as a diode. An inductor, on the other hand, stores energy in a magnetic field when current flows through it, and while a resistor restricts current flow by providing resistance, none of these components directly control or direct the flow of electrons like a diode does.

4. What is true about static electricity?

- A. It moves freely in the circuit**
- B. It does not move**
- C. It is always negative**
- D. It is dangerous to touch**

Static electricity is primarily characterized by the accumulation of electric charge on the surface of objects, which occurs due to friction, contact, or separation. Unlike current electricity, which involves the continuous flow of electrons through a conductor, static electricity involves a stationary charge that does not flow freely in a circuit. This is why the notion that static electricity does not move accurately reflects its nature. When discussing the other options, it's important to note that while static electricity can create potential differences that may discharge in certain conditions (such as when a charged object comes near a conductor), it doesn't inherently involve movement in the way that traditional electrical currents do. Moreover, static electricity can carry both positive and negative charges, which means it's not always negative. While it can be dangerous in certain contexts—such as creating sparks that might ignite flammable materials—this does not universally apply to all static charges or situations. Thus, the characteristic that static electricity does not move is the defining aspect that justifies the correct answer.

5. Which components are included in an RLC circuit?

- A. A resistor, a relay, and a diode
- B. A resistor, an inductor, and a capacitor**
- C. A resistor, a capacitor, and a switch
- D. An inductor, a diode, and a capacitor

An RLC circuit specifically comprises three key components: a resistor, an inductor, and a capacitor. The resistor controls the flow of current in the circuit and dissipates energy as heat. The inductor stores energy in the form of a magnetic field when current flows through it, while the capacitor stores energy in the form of an electric field. Together, these components interact in ways that define the circuit's behavior, particularly in terms of oscillation and resonant frequency. The combination of these elements allows RLC circuits to exhibit unique characteristics such as resonance, where the inductive and capacitive reactances cancel each other out at a certain frequency. This is crucial in applications involving signal processing, tuning circuits, and filtering. Furthermore, analyzing RLC circuits is fundamental in understanding more complex electronic systems. The other combinations mentioned do not correspond to the standard definition of an RLC circuit. A resistor combined with a relay and a diode, or an inductor with a diode and a capacitor, do not encompass the essential relationship and functionality of an RLC circuit, which relies specifically on the interactions between resistance, inductance, and capacitance.

6. What is inductance measured in?

- A. Volts
- B. Ohms
- C. Coulombs
- D. Henry**

Inductance is measured in henries, which is the standard unit named after the American scientist Joseph Henry, who contributed significantly to the study of electromagnetism. The henry quantifies a coil's ability to store energy in a magnetic field when an electric current passes through it. Specifically, one henry is defined as the inductance of a coil in which a change in current of one ampere per second induces an electromotive force (emf) of one volt. Understanding inductance in terms of henries allows for precise calculations and applications in electrical and electronic circuits, such as in transformers, inductors, and various types of AC circuits, impacting their behavior and performance. Other units mentioned, such as volts, ohms, and coulombs, pertain to different electrical concepts—voltage, resistance, and electric charge, respectively—and thus do not measure inductance.

7. What is the unit of electrical resistance?

- A. Coulomb
- B. Volt
- C. Ohm**
- D. Watt

The unit of electrical resistance is the ohm. Resistance is a measure of how much a component opposes the flow of electrical current. The concept of resistance is defined by Ohm's Law, which states that the voltage across a resistor is equal to the current flowing through it multiplied by the resistance. This relationship is expressed mathematically with the formula $V = I * R$, where V is voltage, I is current, and R is resistance measured in ohms. Other electrical units mentioned have different specific meanings and roles in circuits. The coulomb is a unit of electric charge, the volt measures electrical potential difference, and the watt is a unit of power, which describes the rate of energy transfer. Each of these units plays an important role in electricity and electronics, but only the ohm specifically quantifies resistance.

8. What is a common application of a Schmitt trigger in digital electronics?

- A. Frequency modulation
- B. Signal conditioning**
- C. Waveform generation
- D. Timer circuits

A Schmitt trigger is primarily used for signal conditioning in digital electronics. This component effectively improves the quality of the input signal by providing hysteresis, which helps to eliminate noise and makes the transitions between high and low states more stable. When a noisy signal is fed into a Schmitt trigger, the output will only change states when the input passes certain threshold voltages, making it less susceptible to fluctuations or noise that may cause unwanted toggling. This characteristic is particularly valuable in ensuring that digital circuits receive clean, stable signals, which is crucial for reliable operation. In contrast, the other options like frequency modulation, waveform generation, and timer circuits do not primarily make use of Schmitt triggers for their core functionalities. While they can incorporate various components to achieve their goals, they do not specifically rely on the unique properties of Schmitt triggers for signal conditioning in the way that digital electronic applications do. Hence, signal conditioning is the most fitting and common application for a Schmitt trigger.

9. What parameter defines the frequency of an AC signal?

- A. Volts
- B. Ampere
- C. Ohm
- D. Hertz (Hz)**

The frequency of an alternating current (AC) signal is defined by Hertz (Hz), which measures how many cycles of the signal occur in one second. In AC signals, the frequency is a crucial parameter because it determines the rate at which the current changes direction and influences the behavior of the signal in both time and frequency domains. For example, in most household AC power systems, a frequency of 60 Hz means that the current completes 60 cycles every second. This frequency affects not only the voltage and current characteristics but also the performance of electrical devices and circuits designed to operate efficiently at that specific frequency. The other parameters mentioned, such as volts, amperes, and ohms, relate to different characteristics of electrical signals. Volts measure the potential difference, amperes measure the current flow, and ohms measure resistance, but none of these parameters define how often the signal oscillates, which is precisely what Hertz does.

10. What type of analog component can amplify a signal?

- A. Resistor
- B. Capacitor
- C. Diode
- D. Operational amplifier**

An operational amplifier is a key component in analog electronics specifically designed to amplify voltage signals. This versatile device can generate a higher output voltage based on the difference between two input voltages. Operational amplifiers have numerous applications, such as in signal conditioning, filtering, and mathematical operations like addition, subtraction, integration, and differentiation. They are characterized by their high input impedance, which allows them to accept input signals without drawing significant current, and low output impedance, enabling them to drive loads effectively. In contrast, a resistor primarily serves to limit current flow or divide voltages within a circuit but does not amplify signals. A capacitor, on the other hand, stores and releases electrical energy but does not perform amplification functions. Similarly, a diode allows current to flow in one direction and can rectify signals but does not amplify them. Thus, the operational amplifier stands out as the correct choice for the purpose of signal amplification in analog circuits.