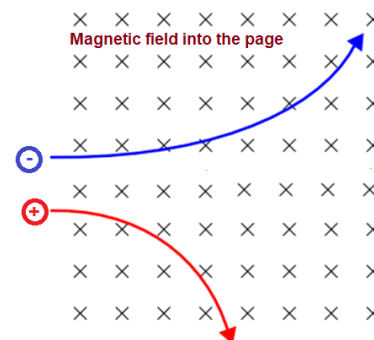


# UNIT-18 MAGNETIC FIELD

## CRQs -SHORT ANSWERED QUESTIONS

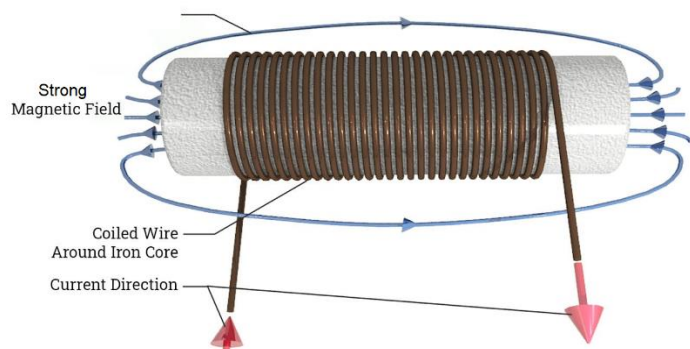
1. **Charge particles are fired in a vacuum tube and hit a fluorescence screen. Will it be possible to know whether they are positive or negative?**

Ans Yes, it is possible to determine whether charged particles fired in a vacuum tube are positive or negative by applying a magnetic field within the tube and observing the deflection of the beam on the fluorescence screen; a magnetic field will deflect positively charged particles in one direction and negatively charged particles in the opposite direction.



2. **What is a solenoid, and how does it differ from a simple coil of wire?**

Ans A solenoid is essentially a tightly wound coil of wire that acts like an electromagnet when electricity flows through it, creating a strong, relatively uniform magnetic field, while a simple coil of wire can be loosely wound and generates a weaker, less consistent magnetic field; the key difference is the high number of closely spaced turns in a solenoid, allowing for a significantly stronger magnetic force when current is applied



3. **Can a solenoid generate a magnetic field without any current flowing through it? Why or why not?**

Ans When electrical current passes through the solenoid, the solenoid creates a magnetic field. The strength of the magnetic field depends on factors such as the amount of current flowing through the coil and the number of turns.

The essential component is the electrical current passing through the coil. Without current, a solenoid alone does not produce a magnetic field.

4. **Explain why a toroid is often preferred over a straight solenoid when designing certain types of electrical components.**

Ans A toroid is often preferred over a straight solenoid in electrical component design because its closed loop shape effectively confines the magnetic field within the core, minimizing "leakage flux" and resulting in significantly reduced electromagnetic interference (EMI), higher efficiency, and better performance in applications where compact size and minimal external magnetic fields are crucial, like in transformers and inductors

# UNIT-18 MAGNETIC FIELD

## 5. What role does Ampere's circuital law play in understanding the magnetic field inside a toroid?

Ans Ampere's circuital law is crucial for understanding the magnetic field inside a toroid because it allows us to directly calculate the magnetic field strength within the toroid by relating the line integral of the magnetic field around a closed loop to the total current enclosed by that loop.

The toroid's symmetry allows us to assume that the magnetic field is constant along the chosen loop, making the calculation simple.

Ampere's law also demonstrates that the magnetic field outside the toroid is essentially zero because any loop drawn outside the toroid will enclose no net current.

## 6. What is a galvanometer, and what is its primary function in an electrical circuit?

Ans A galvanometer is a device used in the electric field to detect the slightest amount of current in an electric field. It has a magnetic needle or a coil in its setup. The movement of this magnetic needle or coil shows current intensity. A galvanometer is a sensitive device. Using a galvanometer, current can be measured in the form of milliamperes, or microampere.

## ERQs - LONG ANSWERED QUESTIONS

### 1. Can a galvanometer measure both DC and AC currents? Explain any limitations it might have with AC measurements.

Ans A galvanometer is an instrument that measures small electric currents. It operates based on the principle of torque acting on a coil placed in a magnetic field.

#### 1. CURRENT TYPES:

**Direct Current (DC):** In a DC circuit, the current flows in one direction and remains constant over time. This allows the galvanometer needle to stabilize at a certain deflection corresponding to the current value.

**Alternating Current (AC):** In an AC circuit, the current changes direction periodically, and its magnitude varies with time. For example, in a sinusoidal AC supply, the current oscillates between positive and negative values.

#### 2. Effect of AC on the Galvanometer:

When AC is applied to the galvanometer, the current continuously switches between positive and negative values. This means the galvanometer needle will attempt to deflect in one direction when the current is positive and in the opposite direction when the current is negative.

#### 3. Inertia of the Needle:

The needle of the galvanometer has inertia, meaning it does not respond instantaneously to changes in current. Due to the rapid oscillation of AC (e.g., 50 Hz in household circuits), the needle does not have enough time to move back and forth between the positive and negative deflections. Instead, it tends to remain stationary or oscillate around a central position.

The galvanometer cannot accurately reflect the rapidly changing current of AC due to the inertia of its needle, it cannot be used to measure alternating current effectively.

# UNIT-18 MAGNETIC FIELD

2. **Why should an ammeter ideally have a very low resistance compared to the circuit it is measuring?**

Ans An ammeter should ideally have a very low resistance compared to the circuit it is measuring because it is connected in series with the circuit, and a high resistance in series would significantly alter the current flow, preventing accurate measurement of the actual current in the circuit; essentially, the ammeter should minimally affect the circuit it's measuring to provide accurate readings.

3. **What is the potential risk of using a voltmeter with a high internal resistance in a circuit? How can this risk be mitigated?**

Ans: *Using a voltmeter with a high internal resistance in a circuit generally minimizes the loading effect, which is desirable for accurate voltage measurements. However, there are potential risks and considerations:*

## **POTENTIAL RISKS:**

### **Sensitivity to Noise:**

High internal resistance can make the voltmeter more sensitive to electrical noise or interference, leading to less stable or inaccurate readings in noisy environments.

### **Slow Response Time:**

Some high-impedance voltmeters may have a slower response time, which can be problematic when measuring rapidly changing voltages.

### **Risk of Damage in High-Voltage Circuits:**

In high-voltage circuits, a high-impedance voltmeter can accumulate charge, potentially leading to arcing or damage to the meter if proper precautions are not taken.

## **MITIGATION STRATEGIES:**

### **1. Use Shielding and Proper Grounding**

Shield the voltmeter and its leads to reduce noise and capacitive coupling. Ensure proper grounding to minimize interference.

### **2. Choose the Right Voltmeter**

Select a voltmeter with a suitable input impedance for the specific application. For high-frequency or noisy environments, a voltmeter with lower input impedance might be more appropriate.

### **3. Avoid High-Voltage Risks**

When working with high-voltage circuits, use voltmeters rated for the voltage levels and follow safety protocols to prevent arcing or damage.

### **4. Calibration and Verification:**

Regularly calibrate the voltmeter and verify its accuracy under the specific conditions of use.

*By addressing these risks and implementing appropriate mitigation strategies, you can ensure accurate and reliable voltage measurements while maintaining safety*

# UNIT-18 MAGNETIC FIELD

4. Describe the basic working principle of a voltmeter. How does it measure voltage across a component in a circuit?

Ans: **The basic principle of a voltmeter**

The basic principle of a voltmeter is that it must be connected in parallel to the circuit in which the voltage has to be measured. A parallel connection is used because a voltmeter is built in such a way that it has a very high resistance value.

## **Measuring Voltage Across a Component**

The voltmeter is connected in parallel with the component whose voltage is to be measured. The positive lead of the voltmeter is connected to the higher potential point, and the negative lead is connected to the lower potential point.

Due to the voltmeter's high internal resistance, only a tiny current flows through it. This current is proportional to the voltage across the component.