Moving Charges Magnetism

MCQs on Biot-Savart Law and Ampere's Circuital Law

Biot-Savart Law and Its Application to Current-Carrying Circular Loop

1. **What does the Biot-Savart law describe?**
   - A. The electric field due to a point charge
   - B. The magnetic field due to a small segment of current
   - C. The force between two parallel current-carrying wires
   - D. The capacitance of a parallel plate capacitor
2. **The Biot-Savart law is mathematically expressed as:**
   - A. $d\mathbf{B} = \frac{\mu_0 I d\mathbf{l} \times \mathbf{r}}{4\pi r^3}$
   - B. $d\mathbf{B} = \frac{\mu_0 I d\mathbf{l} \times \mathbf{r}}{4\pi r^2}$
   - C. $d\mathbf{B} = \frac{\mu_0 I d\mathbf{l} \times \mathbf{r}}{2\pi r^3}$
   - D. $d\mathbf{B} = \frac{\mu_0 I d\mathbf{l} \times \mathbf{r}}{2\pi r^2}$
3. **For a current-carrying circular loop, the magnetic field at the center is given by:**
   - A. $B = \frac{\mu_0 I R}{2}$
   - B. $B = \frac{\mu_0 I}{2R}$
   - C. $B = \frac{\mu_0 I}{4\pi R}$
   - D. $B = \frac{\mu_0 I}{4\pi R^2}$
4. **The direction of the magnetic field at the center of a current-carrying circular loop is determined by:**
   - A. Right-hand thumb rule
   - B. Fleming's left-hand rule
   - C. Lenz's law
   - D. Coulomb's law
5. **If the radius of a current-carrying circular loop is doubled while keeping the current constant, the magnetic field at the center of the loop:**
   - A. Remains the same
   - B. Is halved
   - C. Is doubled
   - D. Is quartered
6. **The magnetic field due to a current element $d\mathbf{l}$ at a point P is inversely proportional to:**
   - A. The square of the distance from the element to P
   - B. The distance from the element to P
   - C. The cube of the distance from the element to P
   - D. The fourth power of the distance from the element to P
7. **Which of the following is true for the Biot-Savart law?**
   - A. It applies to stationary charges
   - B. It applies to steady currents
   - C. It applies to changing magnetic fields
   - D. It applies to non-steady currents

8. **The Biot-Savart law is analogous to which law in electrostatics?**
    - A. Coulomb's law
    - B. Gauss's law
    - C. Faraday's law
    - D. Ampere's law

Ampere’s Circuital Law and Its Application

9. **Ampere’s circuital law is mathematically expressed as:**
    - A. $\oint \mathbf{B} \cdot d\mathbf{l} = \mu_0 I_{\text{enc}}$
    - B. $\oint \mathbf{B} \cdot d\mathbf{l} = \frac{\mu_0 I_{\text{enc}}}{2\pi}$
    - C. $\oint \mathbf{B} \cdot d\mathbf{l} = \frac{I_{\text{enc}}}{\mu_0}$
    - D. $\oint \mathbf{B} \cdot d\mathbf{l} = \frac{I_{\text{enc}}}{2\pi\mu_0}$
10. **Ampere's circuital law is particularly useful in determining the magnetic field:**
    - A. Around a point charge
    - B. Near a dipole
    - C. In symmetric situations
    - D. For non-symmetric distributions
11. **For an infinitely long straight current-carrying wire, the magnetic field at a distance r from the wire is given by:**
    - A. $B = \frac{\mu_0 I}{2\pi r}$
    - B. $B = \frac{\mu_0 I}{4\pi r}$
    - C. $B = \frac{\mu_0 I}{2r}$
    - D. $B = \frac{\mu_0 I}{4r}$
12. **The magnetic field inside a long straight solenoid is:**
    - A. Zero
    - B. Uniform and parallel to the axis
    - C. Uniform and perpendicular to the axis
    - D. Varies along the axis
13. **The magnetic field inside a toroidal solenoid is:**
    - A. Uniform throughout the volume
    - B. Zero at the center and maximum at the edges
    - C. Zero inside and outside the solenoid
    - D. Confined within the core of the toroid
14. **If the number of turns per unit length of a solenoid is doubled, the magnetic field inside the solenoid:**
    - A. Remains the same
    - B. Is halved
    - C. Is doubled
    - D. Is quadrupled
15. **Which of the following is a correct application of Ampere's circuital law?**
    - A. Calculating the electric field due to a point charge
    - B. Determining the magnetic field outside a current-carrying solenoid
    - C. Calculating the magnetic field due to a circular loop at its center
    - D. Determining the magnetic field inside a long straight current-carrying wire

Answer Key
1. B
2. B
3. B
4. A
5. B
6. A
7. B
8. A
9. A
10. C
11. A
12. B
13. D
14. C
15. D