St John Baptist De La Salle Catholic School, Addis Ababa
Grade 12 Physics
Magnetism Practice Questions

December 16, 2024

Multiple Choice Questions

1. A long straight wire carries a current I and generates a magnetic field B. If the current is doubled and the distance from the wire is halved, by what factor does the magnetic field change? A. 2 B. 4 C. 8 D. 16 E. 0.5 F. 0.25

2. A plane flies horizontally at a speed of 180 m/s. The wingspan of the plane is 50 m. The vertical component of the Earth's magnetic field is 6.0×10^{-6} T. What is the emf induced between the wing tips? A. 0.3 V B. 1.8 V C. 0.05 V D. 0.2 V E. None

3. If a current flows through a solenoid, does the solenoid create a uniform or non-uniform magnetic field? A. Uniform magnetic field B. Non-uniform magnetic field C. No magnetic field is produced D. It depends on the material of the solenoid

4. A conductor carrying current is placed in a magnetic field perpendicular to the current. The direction of the force on the conductor is: A. Parallel to the current B. Perpendicular to the current C. Opposite to the direction of the magnetic field D. Cannot be determined without further information

5. Two parallel wires carry currents of 2 A and 3 A in the same direction. The wires are separated by 0.5 m. Find the magnetic force per unit length between the two wires. A. 1.2×10^{-5} N B. 2.4×10^{-5} N C. 1.2×10^{-6} N D. 2.4×10^{-6} N E. None

6. Two long parallel wires carry identical currents in the same direction. The wires are separated by a distance d. If the magnetic field at a point equidistant from the wires is B, what is the magnetic field at a point midway between the wires if the separation is doubled? A. B B. $2B$ C. $\frac{B}{2}$ D. $\frac{B}{4}$ E. None

7. Three parallel wires, each carrying current I, are placed along the sides of an equilateral triangle. Two wires carry current out of the page, and one carries current into the page. Rank the wires according to the magnitude of the net magnetic force on them. A. 1, 2, 3 B. 2, 1, 3 C. 3, 2, 1 D. 1 and 3 tie, then 2 E. 2 and 3 tie, then 1

8. Two long straight wires are placed at the vertices of an equilateral triangle. They each carry current I out of the page. What is the magnetic field at the third vertex due to these two wires? A. 2×10^{-5} T B. 4×10^{-5} T C. 1×10^{-5} T D. 3×10^{-5} T E. 5×10^{-5} T

9. Which of the following statements is correct regarding the relationship between current and magnetic field?

    A. A magnetic field exerts a nonzero force on a stationary charged particle.

    B. A magnetic field exerts a nonzero force on a moving charged particle.

    C. A magnetic field always exerts a nonzero force on a current-carrying conductor.

    D. A magnetic field can be created by a time-varying electric field.

10. A magnetic field of 0.02 T is applied to a coil of wire. The current in the coil is measured to be 3 A. If the number of turns in the coil is doubled, and the magnetic field is increased to 0.06 T, what happens to the current in the coil? A. The current increases by a factor of 2. B. The current decreases by a factor of 2. C. The current remains unchanged. D. The current doubles. E. None of the above

11. A current-carrying wire experiences a magnetic force of 5×10^{-4} N. If the current is doubled and the magnetic field is halved, by what factor does the force change? A. 1 B. 2 C. 4 D. 0.5 E. None of the above

12. A charged particle enters a magnetic field with velocity $v = 10\,\text{m/s}$. The magnetic field is 0.1 T and the angle between the velocity and magnetic field is 30°. What is the magnitude of the force on the particle if its charge is 2 C? A. 0.2 N B. 0.4 N C. 0.6 N D. 1.0 N E. None of the above

13. Two wires, each carrying a current of 4 A, are placed parallel to each other with a separation of 0.3 m. If the currents are in the same direction, what is the magnetic force per unit length between the wires? A. 2.4×10^{-5} N/m B. 4.8×10^{-5} N/m C. 8.0×10^{-5} N/m D. 1.6×10^{-5} N/m E. None of the above

14. The magnetic field inside a solenoid is uniform and depends on the current flowing through it. What happens to the magnetic field if the number of turns per unit length is doubled and the current is halved? A. The magnetic field remains unchanged. B. The magnetic field doubles. C. The magnetic field is halved. D. The magnetic field is quartered. E. None of the above

15. A proton is moving in a magnetic field with velocity $v = 3 \times 10^6\,\text{m/s}$. The magnetic field strength is 0.5 T, and the angle between the velocity and the field is 90°. What is the radius of the proton's path? A. 0.5 m B. 1.0 m C. 2.0 m D. 3.0 m E. None of the above

16. A coil of wire is placed in a magnetic field. If the number of turns in the coil is doubled while keeping the magnetic field strength constant, what happens to the induced emf when the coil rotates? A. The emf doubles. B. The emf is halved. C. The emf remains unchanged. D. The emf becomes zero. E. None of the above

17. Which of the following statements is true regarding magnetic fields?
    A. The magnetic field inside a hollow conductor is always zero.
    B. A moving charge creates a magnetic field perpendicular to its velocity.
    C. A magnetic field cannot exist without an electric field.
    D. The magnetic field due to a current-carrying wire is strongest at points far from the wire.

Free Response Questions

18. Two long parallel wires carry currents in opposite directions. One conductor carries a current of 5 A. The wires are separated by a distance $d = 0.4\,\text{m}$. Find the magnetic field at a point halfway between the wires.
    A Draw the setup of the situation.
    B Find the magnetic field at the point halfway between the wires.
    C Determine the force per unit length between the two wires.

19. A charged particle enters a magnetic field perpendicular to its velocity with a speed of v. If the charge of the particle is q and the magnetic field is B, find the radius of the circular path of the particle.
    A Derive the formula for the radius of the circular path.
    B Find the radius for a particle with charge $q = 2\,\text{C}$, speed $v = 5\,\text{m/s}$, and magnetic field $B = 0.1\,\text{T}$.

20. A straight wire carries a current of 3 A and is placed in a magnetic field of 0.02 T. The length of the wire within the magnetic field is 1.5 m, and the angle between the wire and the magnetic field is 60°. Find the magnetic force on the wire.

A Derive the formula for the magnetic force on a current-carrying wire.

B Calculate the magnetic force on the wire.

21. A circular loop of wire has a radius of 0.5 m and carries a current of 2 A. The loop is placed in a magnetic field of 0.1 T that is perpendicular to the plane of the loop. Find the torque on the loop.

    A Derive the expression for the torque on a current loop in a magnetic field.

    B Calculate the torque on the loop.

22. A current-carrying wire is placed in a magnetic field. The wire is bent into a shape forming a triangle, and the magnetic field is perpendicular to the plane of the triangle. Find the net magnetic force on the wire.

    A Draw a diagram showing the wire and magnetic field.

    B Calculate the magnetic force on each segment of the wire.

    C Find the net magnetic force on the wire.