

What is a Magnetic Field?

Worksheet

A magnetic field, B , describes the strength and direction of magnetic influence at a point, measured in tesla (T). Around a long straight wire, $B = \mu_0 I / (2\pi r)$.

$$B = \mu_0 I / 2\pi r$$

B = magnetic field (T)

I = current (A)

r = distance (m)

Questions

1. What is the unit of magnetic field strength?
A) Newton
B) Tesla
C) Weber
D) Ohm
2. As distance from a current-carrying wire doubles, the magnetic field...
A) doubles
B) stays the same
C) halves
D) quadruples
3. What determines the direction of a magnetic field around a wire?
A) Wire color
B) The right-hand rule
C) Wire length
D) Wire material only
4. What produces a magnetic field?
A) Any electric charge, moving or not
B) Only permanent magnets
C) Moving electric charges (currents) and magnets
D) Only static electricity
5. A long straight wire carries 5 A. Find the magnetic field at 0.02 m from the wire.
6. A wire carries 10 A. Find the magnetic field 0.1 m away.
7. A wire carries 15 A. Find the magnetic field 0.03 m away.
8. Define: What creates a magnetic field?
9. Define: What is the unit of magnetic field strength?
10. Define: What happens to field strength as distance from a wire increases?

Answer Key

1. B) Tesla — Magnetic field strength is measured in tesla (T).
2. C) halves — B is inversely proportional to r, so doubling r halves B.
3. B) The right-hand rule — The right-hand rule gives the field's circular direction around the current.
4. C) Moving electric charges (currents) and magnets — Magnetic fields come from moving charges (currents) and from magnets.
5. $B = \mu_0 I / (2\pi r)$ $B = (2 \times 10^{-7} \times 5) / 0.02$ $B = 0.00005$ T = 50 μ T
6. $B = (2 \times 10^{-7} \times 10) / 0.1$ $B = 0.00002$ T = 20 μ T
7. $B = (2 \times 10^{-7} \times 15) / 0.03$ $B = 0.0001$ T = 100 μ T
8. Moving electric charges — including current in a wire — and permanent magnets.
9. The tesla (T); smaller fields are often given in microtesla (μ T).
10. It decreases — field strength is inversely proportional to distance ($B \propto 1/r$).

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