Glossary

Ampere's law
the physical law that states that the magnetic field around an electric current is proportional to the current; each segment of current produces a magnetic field like that of a long straight wire, and the total field of any shape current is the vector sum of the fields due to each segment

***B*-field**
another term for magnetic field

Biot-Savart law
a physical law that describes the magnetic field generated by an electric current in terms of a specific equation

Curie temperature
the temperature above which a ferromagnetic material cannot be magnetized

direction of magnetic field lines
the direction that the north end of a compass needle points

domains
regions within a material that behave like small bar magnets

electromagnet
an object that is temporarily magnetic when an electrical current is passed through it

electromagnetism
the use of electrical currents to induce magnetism

ferromagnetic
materials, such as iron, cobalt, nickel, and gadolinium, that exhibit strong magnetic effects

gauss
G, the unit of the magnetic field strength; 1 G = 10^{-4} T

Hall effect
the creation of voltage across a current-carrying conductor by a magnetic field

Hall emf
the electromotive force created by a current-carrying conductor by a magnetic field, ε = Blv

Lorentz force
the force on a charge moving in a magnetic field

magnetic field
the representation of magnetic forces

magnetic field lines
the pictorial representation of the strength and the direction of a magnetic field

magnetic field strength (magnitude) produced by a long straight current-carrying wire
defined as $B = \frac{\mu_0 I}{2\pi r}$, where I is the current, r is the shortest distance to the wire, and μ_0 is the permeability of free space

magnetic field strength at the center of a circular loop
defined as $B = \frac{\mu_0 I}{2R}$ where R is the radius of the loop

magnetic field strength inside a solenoid
defined as $B = \mu_0 nI$ where n is the number of loops per unit length of the solenoid ($n = N/l$, with N being the number of loops and l the length)

magnetic force
the force on a charge produced by its motion through a magnetic field; the Lorentz force

magnetic monopoles
an isolated magnetic pole; a south pole without a north pole, or vice versa (no magnetic monopole has ever been observed)

magnetic resonance imaging (MRI)
a medical imaging technique that uses magnetic fields create detailed images of internal tissues and organs

magnetized
to be turned into a magnet; to be induced to be magnetic

magnetocardiogram (MCG)
a recording of the heart's magnetic field as it beats

magnetoencephalogram (MEG)
a measurement of the brain's magnetic field

Maxwell's equations
a set of four equations that describe electromagnetic phenomena

meter
common application of magnetic torque on a current-carrying loop that is very similar in construction to a motor; by design, the torque is proportional to I and not θ, so the needle deflection is proportional to the current

motor
loop of wire in a magnetic field; when current is passed through the loops, the magnetic field exerts torque on the loops, which rotates a shaft; electrical energy is converted to mechanical work in the process

north magnetic pole
the end or the side of a magnet that is attracted toward Earth's geographic north pole

nuclear magnetic resonance (NMR)
a phenomenon in which an externally applied magnetic field interacts with the nuclei of certain atoms

permeability of free space
the measure of the ability of a material, in this case free space, to support a magnetic field; the constant $\mu_0 = 4\pi \times 10^{-7}\ T \cdot \text{m/A}$

right hand rule 1 (RHR-1)
the rule to determine the direction of the magnetic force on a positive moving charge: when the thumb of the right hand points in the direction of the charge's velocity **v** and the fingers point in the direction of the magnetic field **B**, then the force on the charge is perpendicular and away from the palm; the force on a negative charge is perpendicular and into the palm

right hand rule 2 (RHR-2)
a rule to determine the direction of the magnetic field induced by a current-carrying wire: Point the thumb of the right hand in the direction of current, and the fingers curl in the direction of the magnetic field loops

solenoid
a thin wire wound into a coil that produces a magnetic field when an electric current is passed through it

south magnetic pole
the end or the side of a magnet that is attracted toward Earth's geographic south pole

tesla
T, the SI unit of the magnetic field strength; $1\ \text{T} = \frac{1\ \text{N}}{A \cdot m}$