

Electromagnetism: Historical Milestones

Electromagnetism · Answer Key · 8 Questions

1. Which experiment, conducted in 1820 by Hans Christian Ørsted, provided the first direct empirical evidence of a connection between electricity and magnetism?

- A) The discovery of electromagnetic induction using moving magnets near coils.
- B) Observing that a compass needle deflected when placed near an electric current-carrying wire.**
- C) Demonstrating that oppositely charged objects attract and like charges repel.
- D) Measuring the magnetic field produced by a current using a galvanometer.

2. Michael Faraday's 'butterfly net' experiment, a pivotal demonstration in 1831, established the principle of electromagnetic induction. What specific phenomenon did this experiment primarily illustrate?

- A) The generation of electric current by a stationary magnetic field.
- B) The force experienced by a charged particle moving through a magnetic field.
- C) The induction of an electric current in a conductor by a changing magnetic field.**
- D) The creation of magnetism from electric currents.

3. James Clerk Maxwell's groundbreaking work unified electricity and magnetism into a single theoretical framework. His set of equations predicted the existence of electromagnetic waves. What was the speed of these predicted waves?

- A) The speed of sound in air.
- B) The speed of light in a vacuum.**
- C) The speed of a freely falling object near Earth's surface.
- D) A speed dependent on the intensity of the magnetic field.

4. Heinrich Hertz conducted a series of experiments in the late 1880s that experimentally confirmed Maxwell's predictions. What key aspect of Maxwell's theory did Hertz's experiments definitively verify?

- A) The inverse square law for electrostatic forces.
- B) The existence of discrete quanta of electromagnetic energy (photons).
- C) The existence and propagation of electromagnetic waves through space.**
- D) The relationship between electric current and resistance (Ohm's Law).

5. André-Marie Ampère's contributions were crucial in quantifying the relationship between electricity and magnetism. In 1820, shortly after Ørsted's discovery, Ampère formulated a law that describes the magnetic field produced by an electric current. What is this fundamental law known as?

- A) Gauss's Law for Magnetism.
- B) Ampère's Circuital Law.**
- C) Faraday's Law of Induction.
- D) Biot-Savart Law.

6. Before Maxwell's unification, the relationship between electric current and magnetic fields was described by the Biot-Savart law. Who are the two French scientists credited with its formulation in 1820?

- A) Charles-Augustin de Coulomb and Joseph-Louis Lagrange.
- B) Jean-Baptiste Biot and Félix Savart.**
- C) Pierre-Simon Laplace and Siméon Denis Poisson.
- D) Augustin-Jean Fresnel and Hippolyte Pixii.

7. The Hall effect, discovered in 1879 by Edwin Hall, provided crucial information about the nature of charge carriers in conductors. What did the Hall effect demonstrate regarding the movement of charge carriers in response to a magnetic field?

- A) That only electrons can carry electric current.
- B) That electric current is always associated with the movement of positive charges.
- C) That a voltage can be generated across a conductor carrying current when placed in a perpendicular magnetic field, indicating the direction of charge carriers.**
- D) That magnetic fields are generated by rotating electric charges.

8. The concept of the magnetic vector potential, A , which simplifies the calculation of magnetic fields, was developed by several scientists. However, its explicit formulation and widespread use in electromagnetism is often attributed to its inclusion in which comprehensive theoretical work?

- A) Faraday's Experimental Researches in Electricity.
- B) Maxwell's A Treatise on Electricity and Magnetism.**
- C) Ampère's Theory of Electrodynamics.
- D) Hertz's Principles of Mechanics.