# Advanced Principles of Electromagnetism

Physics · Practice Test · 18 Questions

**1. Which of Maxwell's equations describes the absence of magnetic monopoles?**

A) Gauss's Law for magnetism
B) Faraday's Law of induction
C) Ampere's Circuital Law
D) Gauss's Law for electricity

**2. What is the physical significance of the Poynting vector in an electromagnetic field?**

A) The density of magnetic flux
B) The rate of energy transfer per unit area
C) The force exerted on a moving point charge
D) The curvature of space-time

**3. According to the Lorentz force law, what is the force on a charge q moving with velocity v in an electric field E and magnetic field B?**

A) F = q(E + B x v)
B) F = q(v x B) + E
C) F = q(E + v x B)
D) F = q(E + v dot B)

**4. In a vacuum, what is the relationship between the electric field E and magnetic field B of an electromagnetic wave?**

A) They are parallel and in phase
B) They are anti-parallel and out of phase
C) They are perpendicular to each other and to the direction of propagation
D) They are parallel and perpendicular to the direction of propagation

**5. Which term did James Clerk Maxwell add to Ampere's Law to account for time-varying electric fields?**

A) Magnetic susceptibility
B) Displacement current
C) Eddy current
D) Electromotive force

**6. What is the definition of magnetic permeability (u) in a vacuum constant?**

A) 8.854 x 10^-12 F/m
B) 4? x 10^-7 H/m
C) 6.626 x 10^-34 J·s
D) 1.38 x 10^-23 J/K

**7. In the context of electromagnetic radiation, what is the skin effect?**

A) The phenomenon where high-frequency currents flow mostly on the surface of a conductor
B) The process of electromagnetic shielding in lead containers
C) The reflection of radio waves by the ionosphere
D) The heating of tissue by non-ionizing radiation

**8. Which principle states that an induced electromotive force always opposes the change in magnetic flux that produced it?**

A) Coulomb's Law
B) Lenz's Law
C) Biot-Savart Law
D) Kirchhoff's Law

**9. What is the value of the speed of light c in terms of vacuum permittivity (?0) and vacuum permeability (u0)?**

A) c = ?(?0 / u0)
B) c = 1 / ?(?0 * u0)
C) c = ?0 * u0
D) c = ?(u0 / ?0)

**10. What is the unit of magnetic flux in the SI system?**

A) Tesla
B) Weber
C) Henry
D) Gauss

**11. What happens to the electric field inside a perfectly conducting shell in electrostatic equilibrium?**

A) It is equal to the surface charge density
B) It is zero
C) It is proportional to the distance from the center
D) It is inversely proportional to the square of the radius

**12. Which law describes the magnetic field generated by a steady electric current?**

A) Gauss's Law
B) Biot-Savart Law
C) Faraday's Law
D) Coulomb's Law

**13. What is the divergence of the magnetic field B according to Maxwell's equations?**

A) ? / ?0
B) u0 * J
C) 0
D) -?B/?t

**14. What property of a material describes its ability to become magnetized in an applied magnetic field?**

A) Permittivity
B) Magnetic susceptibility
C) Conductivity
D) Resistivity

**15. In electrostatics, what is the relationship between the electric field E and the electric potential V?**

A) E = -?V
B) E = ?V
C) V = -?E
D) V = ? x E

**16. What is the primary factor that determines the characteristic impedance of free space?**

A) The frequency of the electromagnetic wave
B) The ratio of the square root of permeability to permittivity
C) The velocity of the source
D) The gravitational constant

**17. Which phenomenon involves the rotation of the plane of polarization of light when passing through a material in a magnetic field?**

A) Faraday effect
B) Zeeman effect
C) Compton effect
D) Photoelectric effect

**18. What is the SI unit for electric displacement field D?**

A) Coulombs per square meter
B) Volts per meter
C) Amperes per meter
D) Farads