Maxwell's Equations

\[ \nabla \cdot \vec{E} = \rho / \varepsilon_0 \]
\[ \nabla \cdot \vec{B} = 0 \]
\[ \nabla \times \vec{E} = -\partial \vec{B} / \partial t \]
\[ \nabla \times \vec{B} = \mu_0 \vec{J} + \mu_0 \varepsilon_0 \partial \vec{E} / \partial t \]

Any student of electromagnetism must learn these equations, by heart, and their meanings. (See Section 11.1.) Maxwell's construction of these equations was a supreme achievement in mathematical physics.

For polarizable materials, the equations are conveniently written as

\[ \nabla \cdot \vec{D} = \rho_f \]
\[ \nabla \cdot \vec{B} = 0 \]
\[ \nabla \times \vec{E} = -\partial \vec{B} / \partial t \]
\[ \nabla \times \vec{H} = \vec{J}_f + \partial \vec{D} / \partial t \]

where \( \vec{D} = \varepsilon \vec{E} \) and \( \vec{H} = \vec{B} / \mu \).