Maxwell’s Equations

**Gauss' Law for Electricity**

|  |
| --- |
| The electric [flux](http://hyperphysics.phy-astr.gsu.edu/hbase/electric/gaulaw.html#c3) out of any closed surface is proportional to the total [charge](http://hyperphysics.phy-astr.gsu.edu/hbase/electric/elecur.html#c2) enclosed within the surface.The integral form of [Gauss' Law](http://hyperphysics.phy-astr.gsu.edu/hbase/electric/gaulaw.html#c2) finds application in calculating [electric fields](http://hyperphysics.phy-astr.gsu.edu/hbase/electric/gaulaw.html#c4)around charged objects. |



# Gauss' Law for Magnetism

The net [magnetic flux](http://hyperphysics.phy-astr.gsu.edu/hbase/magnetic/fluxmg.html#c1) out of any closed surface is zero. This amounts to a statement about the sources of magnetic field. For a magnetic dipole, any closed surface the magnetic flux directed inward toward the south pole will equal the flux outward from the north pole. The net flux will always be zero for dipole sources. If there were a magnetic monopole source, this would give a non-zero [area integral](http://hyperphysics.phy-astr.gsu.edu/hbase/intare.html#c1).



# Faraday's Law of Induction

The [line integral](http://hyperphysics.phy-astr.gsu.edu/hbase/intare.html#c2) of the [electric field](http://hyperphysics.phy-astr.gsu.edu/hbase/electric/elefie.html#c1) around a closed loop is equal to the negative of the rate of change of the [magnetic flux](http://hyperphysics.phy-astr.gsu.edu/hbase/magnetic/fluxmg.html#c1) through the area enclosed by the loop.

This line integral is equal to the [generated voltage](http://hyperphysics.phy-astr.gsu.edu/hbase/electric/farlaw.html#c1)or [emf](http://hyperphysics.phy-astr.gsu.edu/hbase/electric/elevol.html%22%20%5Cl%20%22c2) in the loop, so Faraday's law is the basis for [electric generators](http://hyperphysics.phy-astr.gsu.edu/hbase/magnetic/motorac.html#c2). It also forms the basis for[inductors](http://hyperphysics.phy-astr.gsu.edu/hbase/electric/induct.html#c1) and [transformers](http://hyperphysics.phy-astr.gsu.edu/hbase/magnetic/transf.html#c1).



# Ampere's Law

In the case of static [electric field](http://hyperphysics.phy-astr.gsu.edu/hbase/electric/elefie.html#c1), the[line integral](http://hyperphysics.phy-astr.gsu.edu/hbase/intare.html#c2) of the [magnetic field](http://hyperphysics.phy-astr.gsu.edu/hbase/magnetic/magfie.html#c1)around a closed loop is proportional to the [electric current](http://hyperphysics.phy-astr.gsu.edu/hbase/electric/elecur.html#c1) flowing through the loop. This is useful for the [calculation of magnetic field](http://hyperphysics.phy-astr.gsu.edu/hbase/magnetic/amplaw.html#c2)for simple geometries.





Also for an LC circuit the frequency is related by

2\*pi\*f = 1/(sqrt(LC)