Magnetic Flux and Gauss’s Law for \( B \)

Magnetic flux is defined analogously to electric flux:
\[
\oint_S \vec{B} \cdot d\vec{A}
\]
where the integral is over a surface \( S \). The unit of magnetic flux \((1 \, \text{T-m}^2)\) is given a name, the weber, where \( 1 \, \text{Wb} = 1 \, \text{T-m}^2 \). The calculation of the magnetic flux is identical in principle to that of the electric flux.

Gauss’s law for magnetism states that the flux of \( B \) through any closed surface is always equal to zero:
\[
\oiint_S \vec{B} \cdot d\vec{A} = 0.
\]

We can understand this in the context of Gauss’s law for \( E \) by realizing that there are no isolated magnetic charges (poles of a magnet), and so there are no sources or sinks for magnetic field lines. Magnetic field lines must form closed curves or extend to infinity.