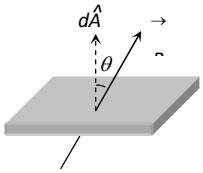
Magnetic Flux

The total number of magnetic lines of force passing normally through an area placed in a magnetic field is equal to the magnetic flux linked with that area.



For elementary area dA of a surface flux linked $d\phi = B\,dA\cos\theta$ or $d\phi = \vec{B}\cdot d\vec{A}$

So, Net flux through the surface $\boldsymbol{\phi = \oint \vec{B}\cdot d\vec{A} = BA\cos\theta}$

For N-turns coil ϕ = NBA cosθ

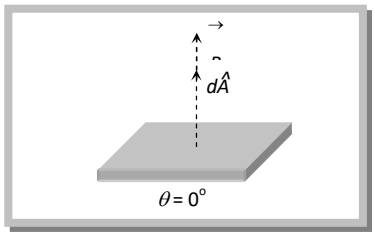
(1) **Unit and Dimension**

Magnetic flux is a scalar quantity it's S.I. unit is weber (wb), CGS unit is Maxwell or Gauss × cm^2; $1\,wb = 10^8\ Maxwell$. Other units: Tesla × $m^2 = \frac{N\times m}{Amp} = \frac{Joule}{Amp} = \frac{Volt\times Coulomb}{Amp} = Volt\times sec$ = Ohm × Coulomb = Henry × Amp. It's dimensional formula $[\phi] = [ML^2T^{-2}A^{-1}]$

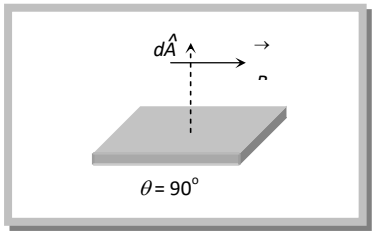
(2) **Maximum and Zero flux**

If θ = 0°, i.e. plane is held perpendicular to the direction of magnetic field then flux from the surface is maximum and if $\theta = 90^o$ i.e. plane is held parallel to the direction of magnetic field then flux linked with the surface is zero.

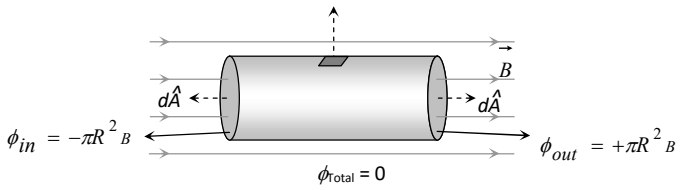
$\phi_{max} = BA$



$\phi = 0$

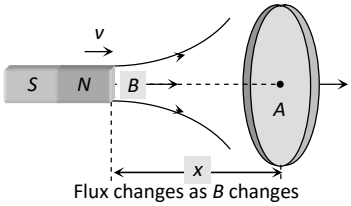
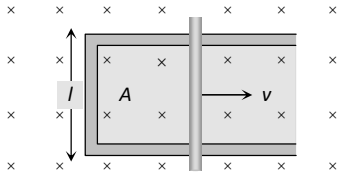
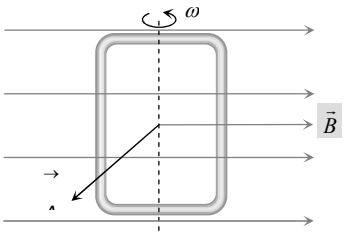
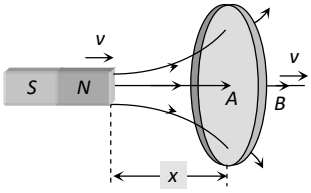
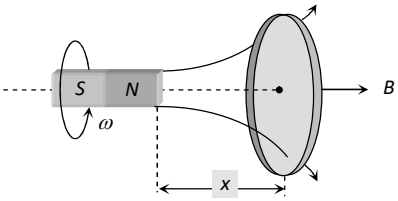
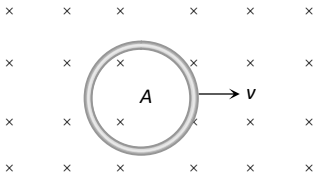


Note: In case of a body present in a field, either uniform or non-uniform, outward flux is taken to be positive while inward negative and Net flux linked with a closed surface is zero i.e. $\phi = \oint \vec{B}\cdot d\vec{s} = 0$



(3) **Variation of magnetic flux**

We know that magnetic flux linked with an area A is $\phi = BA\cos\theta$ i.e. ϕ will change if either B, A or θ will change

Flux changes	**Flux not changes**
 Flux changes as *B* changes  Flux changes as area (swept by rod) changes  Flux changes as θ changes	   In all these three cases flux ϕ will not change because B, A and θ doesn't change with time