# Similarities between Electrical and Magnetic Situations

| **Concept** | **Electrical** | **Magnetic** |
|---|---|---|
| What moves*? (What is produced?) | Current (*I*) | Flux (Φ) |
| Units? | Ampéres (*A*) | Webers (Wb) |
| What drives the motion†?<br>(What does the producing?) | Potential Difference (*V*)<br>(*aka Electromotive Force*) | Current-Turns (NI)<br>(*aka Magnetomotive Force*) |
| Units? | Volts (V) | Ampéres (A) |
| Ease of moving through a specific object? | Conductance (*G*)<br>$G = \frac{I}{V}$ | Permeance (Λ)<br>$\Lambda = \frac{\Phi}{NI}$ |
| Units? | Siemens (S) or $AV^{-1}$ | $WbA^{-1}$ |
| Ease of moving through a substance? | Conductivity (*σ*)<br>$\sigma = \frac{Gl}{A}$ | Permeability (*μ*)<br>$\mu = \frac{\Lambda l}{A}$ |
| Units? | $Sm^{-1}$ or $AV^{-1}m^{-1}$ | $WbA^{-1}m^{-1}$ |
| Difficulty of moving through a specific object? | Resistance (*R*)<br>$R = \frac{V}{I}$ | Reluctance (ℜ)<br>$\Re = \frac{NI}{\Phi}$ |
| Units? | Ohms (Ω) or $VA^{-1}$ | $AWb^{-1}$ |
| Difficulty of moving through a substance? | Resistivity (*ρ*)<br>$\rho = \frac{RA}{l}$ | Reluctivity (*Not really used*)<br>$= \frac{A}{\Lambda l}$ |
| Units? | Ωm | $AmWb^{-1}$ |

Just to confuse you further, there is a magnetic phenomenon called Coercivity which is when a magnetic material retains its magnetism after the external field is switched off (so coercivity is low in (magnetically) soft iron, greater in (magnetically hard) steel).

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* Remember that nothing <u>really</u> moves in a magnetic circuit!

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