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Magnetism Unit Conversion Chart

Quick reference guide for magnetic measurement units

Magnetic Flux Units

Unit	Symbol	SI Equivalent	Description
Weber	Wb	Vs (volt-second)	SI unit of magnetic flux
Maxwell	Mx	10^{-8} Wb	CGS unit of magnetic flux
Unit Pole	-	1.256×10^{-7} Wb	Obsolete unit in CGS system

Magnetic Flux Density (Field) Units

Unit	Symbol	SI Equivalent	Description
Tesla	T	Wb/m²	SI unit of magnetic flux density
Gauss	G	10^{-4} T	CGS unit of magnetic flux density
Gamma	γ	10^{-9} T	Used for Earth's magnetic field

Magnetic Field Strength Units

Unit	Symbol	SI Equivalent	Description
Ampere per meter	A/m	A/m	SI unit of magnetic field strength
Oersted	Oe	79.577 A/m	CGS unit of magnetic field strength
Gilbert per centimeter	Gi/cm	79.577 A/m	Alternative CGS unit

Magnetomotive Force Units

Unit	Symbol	SI Equivalent	Description
Ampere-turn	A	A	SI unit of magnetomotive force
Gilbert	Gi	0.7958 A	CGS unit of magnetomotive force

Magnetic Permeability Units

Unit	Symbol	SI Equivalent	Description
Henry per meter	H/m	H/m	SI unit of magnetic permeability
Gauss per oersted	G/Oe	1.257×10^{-6} H/m	CGS unit of permeability
Vacuum permeability	μ_0	$4\pi \times 10^{-7}$ H/m	Permeability of free space

Magnetic Moment Units

Unit	Symbol	SI Equivalent	Description
Ampere-square meter	A·m²	A·m²	SI unit of magnetic moment
Erg per gauss	erg/G	10^{-3} A·m²	CGS unit of magnetic moment
Bohr magneton	μ_β	9.274×10^{-24} A·m²	Used in atomic physics

Common Magnetic Unit Conversions

From	To	Conversion Factor	Example
Tesla (T)	Gauss (G)	Multiply by 10,000	1 T = 10,000 G
Gauss (G)	Tesla (T)	Divide by 10,000	10,000 G = 1 T
Weber (Wb)	Maxwell (Mx)	Multiply by 10^8	1 Wb = 10^8 Mx
Maxwell (Mx)	Weber (Wb)	Divide by 10^8	10^8 Mx = 1 Wb
Ampere per meter (A/m)	Oersted (Oe)	Divide by 79.577	79.577 A/m = 1 Oe
Oersted (Oe)	Ampere per meter (A/m)	Multiply by 79.577	1 Oe = 79.577 A/m
Ampere-turn (A)	Gilbert (Gi)	Multiply by 1.257	1 A = 1.257 Gi
Gilbert (Gi)	Ampere-turn (A)	Multiply by 0.7958	1 Gi = 0.7958 A

Magnetic Field Strength Reference Values

Source or Environment	Typical Field Strength in Tesla (T)	Field Strength in Gauss (G)
Earth's magnetic field	25-65 µT	0.25-0.65 G
Refrigerator magnet	5-10 mT	50-100 G
Strong permanent magnet (Neodymium)	1-1.4 T	10,000-14,000 G
MRI machine	1.5-7 T	15,000-70,000 G
Research electromagnet	up to 45 T	up to 450,000 G
Neutron star (estimated at surface)	10^8-10^{11} T	10^{12}-10^{15} G

Key Magnetic Equations

- **Magnetic flux density and field strength:** $B = \mu_0\mu_r H$ (B = flux density, μ_0 = permeability of free space, μ_r = relative permeability, H = field strength)
- **Magnetic flux:** $\Phi = B \times A$ (Φ = magnetic flux, B = flux density, A = area)
- **Lorentz force:** $F = qv \times B$ (F = force, q = charge, v = velocity, B = flux density)
- **Ampère's law:** $\oint H \cdot dl = I$ (H = field strength, I = current)
- **Faraday's law:** $\varepsilon = -d\Phi/dt$ (ε = induced emf, Φ = magnetic flux)
- **Biot-Savart law:** $dB = (\mu_0/4\pi) \times (I\, dl \times \hat{r}/r^2)$
- **Magnetic energy density:** $u = B^2/2\mu_0$ (u = energy density, B = flux density)

Practical Examples of Magnetic Conversions

MRI Field Strength

A 3 Tesla MRI machine has a magnetic field of 3 T × 10,000 G/T = 30,000 Gauss. This is about 60,000 times stronger than Earth's magnetic field of approximately 0.5 Gauss.

Electrical Engineering

A solenoid produces a magnetic field strength of 2,000 A/m. Converting to oersted: 2,000 A/m ÷ 79.577 = 25.13 Oe. This measurement helps engineers select appropriate core materials for transformers.

Geomagnetic Measurements

Earth's magnetic field measured at 45,000 nT (nanotesla) can be converted to gauss: 45,000 nT = 45 × 10^{-6} T = 0.45 G. Geomagnetic studies often use these measurements to track changes in Earth's magnetic field.

Magnetic Shielding

A magnetic shield needs to reduce a 1,000 G field to below 10 G. The required shielding factor is 1,000 G ÷ 10 G = 100×. Materials with high magnetic permeability (μ_r) of at least 100 would be needed.