Important Magnetism Formulas PDF

Formulas
Examples
with Units

List of 17
Important Magnetism Formulas

1) Angle of Dip Formula

Evaluate Formula

Formula

$$\delta = \arccos\left(\frac{B_H}{B_V}\right)$$

Example with Units

$$60° = \arccos\left(\frac{0.00002\,\text{Wb/m}^2}{0.00004\,\text{Wb/m}^2}\right)$$

2) Current in Moving Coil Galvanometer Formula

Evaluate Formula

Formula

$$i = \frac{K_{spring} \cdot \theta_G}{n \cdot A_{cross\text{-}sectional} \cdot B}$$

Example with Units

$$0.1256\,\text{A} = \frac{2.99\,\text{N/m} \cdot 32°}{95 \cdot 10000\,\text{m}^2 \cdot 1.4\text{E-}5\,\text{Wb/m}^2}$$

3) Electric Current for Tangent Galvanometer Formula

Evaluate Formula

Formula

$$i_{galvanometer} = K \cdot \tan\left(\theta_G\right)$$

Example with Units

$$0.0008\,\text{A} = 0.00123\,\text{A} \cdot \tan\left(32°\right)$$

4) Field Inside Solenoid Formula

Evaluate Formula

Formula

$$B = \frac{[\text{Permeability-vacuum}] \cdot i \cdot N}{L_{solenoid}}$$

Example with Units

$$0.0001\,\text{Wb/m}^2 = \frac{1.3\text{E-}6 \cdot 0.1249\,\text{A} \cdot 71}{0.075\,\text{m}}$$

5) Field of Bar Magnet at Axial position Formula

Evaluate Formula

Formula

$$B_{axial} = \frac{2 \cdot [\text{Permeability-vacuum}] \cdot M}{4 \cdot \pi \cdot a^3}$$

Example with Units

$$4.0808\,\text{Wb/m}^2 = \frac{2 \cdot 1.3\text{E-}6 \cdot 90\,\text{Wb/m}^2}{4 \cdot 3.1416 \cdot 0.0164\,\text{m}^3}$$

6) Field of Bar Magnet at Equatorial position Formula

Evaluate Formula

Formula

$$B_{equitorial} = \frac{[\text{Permeability-vacuum}] \cdot M}{4 \cdot \pi \cdot a^3}$$

Example with Units

$$2.0404\,\text{Wb/m}^2 = \frac{1.3\text{E-}6 \cdot 90\,\text{Wb/m}^2}{4 \cdot 3.1416 \cdot 0.0164\,\text{m}^3}$$

7) Force between Parallel Wires Formula

Evaluate Formula

Formula

$$F_l = \frac{[\text{Permeability-vacuum}] \cdot I_1 \cdot I_2}{2 \cdot \pi \cdot d}$$

Example with Units

$$0.0005\,\text{N/m} = \frac{1.3\text{E-}6 \cdot 1.1\,\text{A} \cdot 4\,\text{A}}{2 \cdot 3.1416 \cdot 0.00171\,\text{m}}$$

8) Magnetic Field at Center of Arc Formula

Evaluate Formula

Formula

$$M_{arc} = \frac{[\text{Permeability-vacuum}] \cdot i \cdot \theta_{arc}}{4 \cdot \pi \cdot r_{ring}}$$

Example with Units

$$1.8\text{E-}8\,\text{Wb/m}^2 = \frac{1.3\text{E-}6 \cdot 0.1249\,\text{A} \cdot 0.5^\circ}{4 \cdot 3.1416 \cdot 0.006\,\text{m}}$$

9) Magnetic Field at Center of Ring Formula

Evaluate Formula

Formula

$$M_{ring} = \frac{[\text{Permeability-vacuum}] \cdot i}{2 \cdot r_{ring}}$$

Example with Units

$$1.3\text{E-}7\,\text{Wb/m}^2 = \frac{1.3\text{E-}6 \cdot 0.1249\,\text{A}}{2 \cdot 0.006\,\text{m}}$$

10) Magnetic Field Due to Infinite Straight Wire Formula

Evaluate Formula

Formula

$$B = \frac{[\text{Permeability-vacuum}] \cdot i}{2 \cdot \pi \cdot d}$$

Example with Units

$$1.5\text{E-}5\,\text{Wb/m}^2 = \frac{1.3\text{E-}6 \cdot 0.1249\,\text{A}}{2 \cdot 3.1416 \cdot 0.00171\,\text{m}}$$

11) Magnetic Field due to Straight Conductor Formula

Evaluate Formula

Formula

$$B = \frac{[\text{Permeability-vacuum}] \cdot i}{4 \cdot \pi \cdot d} \cdot \left(\cos\left(\theta_1\right) - \cos\left(\theta_2\right)\right)$$

Example with Units

$$1.5\text{E-}6\,\text{Wb/m}^2 = \frac{1.3\text{E-}6 \cdot 0.1249\,\text{A}}{4 \cdot 3.1416 \cdot 0.00171\,\text{m}} \cdot \left(\cos\left(45^\circ\right) - \cos\left(60^\circ\right)\right)$$

12) Magnetic Field for Tangent Galvanometer Formula

Evaluate Formula

Formula

$$B_H = \frac{[\text{Permeability-vacuum}] \cdot n \cdot K}{2 \cdot r_{ring} \cdot \tan\left(\theta_G\right)}$$

Example with Units

$$2\text{E-}5\,\text{Wb/m}^2 = \frac{1.3\text{E-}6 \cdot 95 \cdot 0.00123\,\text{A}}{2 \cdot 0.006\,\text{m} \cdot \tan\left(32^\circ\right)}$$

13) Magnetic Field on Axis of Ring Formula

Evaluate Formula

Formula

$$B = \frac{[\text{Permeability-vacuum}] \cdot i \cdot r_{ring}^{2}}{2 \cdot \left(r_{ring}^{2} + d^{2} \right)^{\frac{3}{2}}}$$

Example with Units

$$1.2\text{E-}5\,\text{Wb/m}^2 = \frac{1.3\text{E-}6 \cdot 0.1249\,\text{A} \cdot 0.006\,\text{m}^{2}}{2 \cdot \left(0.006\,\text{m}^{2} + 0.00171\,\text{m}^{2} \right)^{\frac{3}{2}}}$$

14) Magnetic Flux Formula

Evaluate Formula

Formula

$$\Phi_m = B \cdot A \cdot \cos\left(\theta_1 \right)$$

Example with Units

$$6.5\text{E-}5\,\text{Wb} = 1.4\text{E-}5\,\text{Wb/m}^2 \cdot 6.6\,\text{m}^2 \cdot \cos\left(45° \right)$$

15) Magnetic Force Formula

Evaluate Formula

Formula

$$F_{mm} = |I| \cdot L_{rod} \cdot \left(B \cdot \sin\left(\theta_2 \right) \right)$$

Example with Units

$$0.0217\,\text{N} = 980\,\text{A} \cdot 1.83\,\text{m} \cdot \left(1.4\text{E-}5\,\text{Wb/m}^2 \cdot \sin\left(60° \right) \right)$$

16) Magnetic Permeability Formula

Evaluate Formula

Formula

$$\mu = \frac{B}{H}$$

Example with Units

$$3.1\text{E-}5\,\text{H/m} = \frac{1.4\text{E-}5\,\text{Wb/m}^2}{0.45\,\text{A/m}}$$

17) Time Period of Magnetometer Formula

Evaluate Formula

Formula

$$T = 2 \cdot \pi \cdot \sqrt{\frac{I}{M \cdot B_H}}$$

Example with Units

$$157.0796\,\text{s} = 2 \cdot 3.1416 \cdot \sqrt{\frac{1.125\,\text{kg·m}^2}{90\,\text{Wb/m}^2 \cdot 0.00002\,\text{Wb/m}^2}}$$

Variables used in list of Magnetism Formulas above

- **|I|** Current Magnitude *(Ampere)*
- **a** Distance from Center to Point *(Meter)*
- **A** Area *(Square Meter)*
- $A_{cross\text{-}sectional}$ Cross-Sectional Area *(Square Meter)*
- **B** Magnetic Field *(Weber per Square Meter)*
- B_{axial} Field at Axial Position of Bar Magnet *(Weber per Square Meter)*
- $B_{equitorial}$ Field at Equatorial Position of Bar Magnet *(Weber per Square Meter)*
- B_H Horizontal Component of Earth's Magnetic Field *(Weber per Square Meter)*
- B_V Vertical Component of Earth's Magnetic Field *(Weber per Square Meter)*
- **d** Perpendicular Distance *(Meter)*
- F_{mm} Magnetic Force *(Newton)*
- F_l Magnetic Force per Unit Length *(Newton per Meter)*
- **H** Magnetic Field Intensity *(Ampere per Meter)*
- **i** Electric Current *(Ampere)*
- **I** Moment of Inertia *(Kilogram Square Meter)*
- I_1 Electric Current in Conductor 1 *(Ampere)*
- I_2 Electric Current in Conductor 2 *(Ampere)*
- $i_{galvanometer}$ Electric Current for Tangent Galvanometer *(Ampere)*
- **K** Reduction Factor of Tangent Galvanometer *(Ampere)*
- K_{spring} Spring Constant *(Newton per Meter)*
- L_{rod} Length of Rod *(Meter)*
- $L_{solenoid}$ Length of Solenoid *(Meter)*
- **M** Magnetic Moment *(Weber per Square Meter)*
- M_{arc} Field at Center of Arc *(Weber per Square Meter)*
- M_{ring} Field at Center of Ring *(Weber per Square Meter)*

Constants, Functions, Measurements used in list of Magnetism Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- constant(s): **[Permeability-vacuum]**, 1.2566E-6 *Permeability of vacuum*
- Functions: **arccos**, arccos(Number) *Arccosine function, is the inverse function of the cosine function.It is the function that takes a ratio as an input and returns the angle whose cosine is equal to that ratio.*
- Functions: **cos**, cos(Angle) *Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.*
- Functions: **sin**, sin(Angle) *Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.*
- Functions: **sqrt**, sqrt(Number) *A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.*
- Functions: **tan**, tan(Angle) *The tangent of an angle is a trigonometric ratio of the length of the side opposite an angle to the length of the side adjacent to an angle in a right triangle.*
- Measurement: **Length** in Meter (m) *Length Unit Conversion*
- Measurement: **Time** in Second (s) *Time Unit Conversion*
- Measurement: **Electric Current** in Ampere (A) *Electric Current Unit Conversion*
- Measurement: **Area** in Square Meter (m²) *Area Unit Conversion*
- Measurement: **Force** in Newton (N) *Force Unit Conversion*
- Measurement: **Angle** in Degree (°) *Angle Unit Conversion*
- Measurement: **Magnetic Flux** in Weber (Wb) *Magnetic Flux Unit Conversion*

- **n** Number of Turns of Coil
- **N** Number of Turns
- r_{ring} Radius of Ring *(Meter)*
- **T** Time Period of Magnetometer *(Second)*
- **δ** Angle of Dip *(Degree)*
- θ_1 Theta 1 *(Degree)*
- θ_2 Theta 2 *(Degree)*
- θ_{arc} Angle Obtained by Arc at Center *(Degree)*
- θ_G Angle of Deflection of Galvanometer *(Degree)*
- **μ** Magnetic Permeability of Medium *(Henry per Meter)*
- Φ_m Magnetic Flux *(Weber)*

- Measurement: **Magnetic Field Strength** in Ampere per Meter (A/m)
  Magnetic Field Strength Unit Conversion
- Measurement: **Magnetic Field** in Weber per Square Meter (Wb/m^2)
  Magnetic Field Unit Conversion
- Measurement: **Surface Tension** in Newton per Meter (N/m)
  Surface Tension Unit Conversion
- Measurement: **Moment of Inertia** in Kilogram Square Meter ($kg \cdot m^2$)
  Moment of Inertia Unit Conversion
- Measurement: **Magnetic Permeability** in Henry per Meter (H/m)
  Magnetic Permeability Unit Conversion
- Measurement: **Stiffness Constant** in Newton per Meter (N/m)
  Stiffness Constant Unit Conversion

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