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Magnetism Formulas

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List of 17 Magnetism Formulas

Magnetism

1) Angle of Dip

Open Calculator

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

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

2) Current in Moving Coil Galvanometer

Open Calculator

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

ex $$0.125559\text{A} = \frac{2.99\text{N/m} \cdot 32^\circ}{95 \cdot 10000\text{m}^2 \cdot 1.4\text{E}\hat{}\text{-}5\text{Wb/m}^2}$$

3) Electric Current for Tangent Galvanometer

Open Calculator

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

ex $$0.000769\text{A} = 0.00123\text{A} \cdot \tan(32^\circ)$$

4) Field Inside Solenoid

Open Calculator

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

$$0.000149\text{Wb/m}^2 = \frac{[\text{Permeability-vacuum}] \cdot 0.1249\text{A} \cdot 71}{0.075\text{m}}$$

5) Field of Bar Magnet at Axial position

Open Calculator

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

$$4.080759\text{Wb/m}^2 = \frac{2 \cdot [\text{Permeability-vacuum}] \cdot 90\text{Wb/m}^2}{4 \cdot \pi \cdot (0.0164\text{m})^3}$$

6) Field of Bar Magnet at Equatorial position

Open Calculator

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

$$2.04038\text{Wb/m}^2 = \frac{[\text{Permeability-vacuum}] \cdot 90\text{Wb/m}^2}{4 \cdot \pi \cdot (0.0164\text{m})^3}$$

7) Force between Parallel Wires

Open Calculator

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

$$0.000515\text{N/m} = \frac{[\text{Permeability-vacuum}] \cdot 1.1\text{A} \cdot 4\text{A}}{2 \cdot \pi \cdot 0.00171\text{m}}$$

8) Magnetic Field at Center of Arc

Open Calculator

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

ex $1.8E\hat{}\text{-}8 Wb/m^2 = \frac{[Permeability\text{-}vacuum] \cdot 0.1249A \cdot 0.5^\circ}{4 \cdot \pi \cdot 0.006m}$

9) Magnetic Field at Center of Ring

Open Calculator

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

ex $1.3E\hat{}\text{-}7 Wb/m^2 = \frac{[Permeability\text{-}vacuum] \cdot 0.1249A}{2 \cdot 0.006m}$

10) Magnetic Field Due to Infinite Straight Wire

Open Calculator

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

ex $1.5E\hat{}\text{-}5 Wb/m^2 = \frac{[Permeability\text{-}vacuum] \cdot 0.1249A}{2 \cdot \pi \cdot 0.00171m}$

11) Magnetic Field due to Straight Conductor

Open Calculator

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

ex $1.5E\hat{}\text{-}6 Wb/m^2 = \frac{[Permeability\text{-}vacuum] \cdot 0.1249A}{4 \cdot \pi \cdot 0.00171m} \cdot (\cos(45^\circ) - \cos(60^\circ))$

12) Magnetic Field for Tangent Galvanometer

Open Calculator

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

ex $2\text{E}\hat{}\text{-5Wb/m}^2 = \frac{[\text{Permeability-vacuum}] \cdot 95 \cdot 0.00123\text{A}}{2 \cdot 0.006\text{m} \cdot \tan(32^\circ)}$

13) Magnetic Field on Axis of Ring

Open Calculator

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

ex $1.2\text{E}\hat{}\text{-5Wb/m}^2 = \frac{[\text{Permeability-vacuum}] \cdot 0.1249\text{A} \cdot (0.006\text{m})^2}{2 \cdot \left((0.006\text{m})^2 + (0.00171\text{m})^2\right)^{\frac{3}{2}}}$

14) Magnetic Flux

Open Calculator

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

ex $6.5\text{E}\hat{}\text{-5Wb} = 1.4\text{E}\hat{}\text{-5Wb/m}^2 \cdot 6.6\text{m}^2 \cdot \cos(45^\circ)$

15) Magnetic Force

Open Calculator

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

ex $0.021744\text{N} = 980\text{A} \cdot 1.83\text{m} \cdot (1.4\text{E}\hat{}\text{-5Wb/m}^2 \cdot \sin(60^\circ))$

16) Magnetic Permeability

Open Calculator

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

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

17) Time Period of Magnetometer

Open Calculator

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

ex $$157.0796s = 2 \cdot \pi \cdot \sqrt{\frac{1.125kg \cdot m^2}{90Wb/m^2 \cdot 0.00002Wb/m^2}}$$

Variables Used

- **|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)*
- 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)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Constant: **[Permeability-vacuum]**, 1.2566E-6
  Permeability of vacuum
- Function: **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.
- Function: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Function: **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.
- Function: **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.
- Function: **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
- Measurement: **Magnetic Field Strength** in Ampere per Meter (A/m)
  Magnetic Field Strength Unit Conversion
- Measurement: **Magnetic Field** in Weber per Square Meter (Wb/m²)
  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·m²)
  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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