



Current Electricity Formulas

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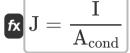


List of 30 Current Electricity Formulas

Current Electricity

Basics of Current Electricity

1) Current Density given Electric Current and Area



Open Calculator

$$0.402299 \mathrm{A/mm^2} = rac{2.1 \mathrm{A}}{5.22 \mathrm{mm^2}}$$

2) Current Density given Resistivity



Open Calculator 🚰

$$ext{ex} \ 35.29412 ext{A/mm}^2 = rac{600 ext{V/m}}{0.017 \Omega^* ext{mm}}$$

3) Drift Speed

$$V_{
m d} = rac{{
m E} \cdot {f au} \cdot {
m [Charge-e]}}{2 \cdot {
m [Mass-e]}}$$

Open Calculator

$$oxed{ex} 2.6 ext{E^15mm/s} = rac{600 ext{V/m} \cdot 0.05 ext{s} \cdot [ext{Charge-e}]}{2 \cdot [ext{Mass-e}]}$$







4) Drift Speed given Cross-Sectional Area

 $\left[\mathbf{V}_{\mathrm{d}} = rac{\mathbf{r}}{\mathrm{e}^{ ext{-}} \cdot \left[\mathrm{Charge-e} \right] \cdot \mathrm{A}}
ight]$

Open Calculator 2

 $ext{ex} 1.9 ext{E^26mm/s} = rac{2.1 ext{A}}{5 \cdot [ext{Charge-e}] \cdot 14 ext{mm}^2}$

5) Electric Current given Charge and Time

fx $m I = rac{q}{T_{Total}}$

 $0.00375A = \frac{0.3C}{80s}$

6) Electric Current given Drift Velocity

Open Calculator 2

Open Calculator

Open Calculator 2

fx $I = n \cdot [ext{Charge-e}] \cdot A \cdot V_d$

ex $1.6E^-27A = 7 \cdot [Charge-e] \cdot 14mm^2 \cdot 0.1mm/s$

7) Electric Field

 $\mathbf{fx} ig| \mathbf{E} = rac{\Delta \mathbf{V}}{1} ig|$

$$\Delta V$$

$$=$$
 $20V/m = \frac{18V}{0.9m}$



8) Electromotive Force when Battery is Charging

fx $V_{
m electromotive} = \epsilon + I \cdot R$

Open Calculator 🖸

- $\textbf{ex} \ 33.3 \text{V} = 1.8 \text{V} + 2.1 \text{A} \cdot 15 \Omega$
- 9) Electromotive Force when Battery is Discharging
- $V_{
 m electromotive} = \epsilon I \cdot R$

Open Calculator

 $\texttt{ex} \ \texttt{-}29.7 \text{V} = 1.8 \text{V} - 2.1 \text{A} \cdot 15 \Omega$

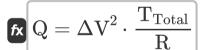
Energy and Power

10) Heat Energy given Electric Potential Difference and Electric Current

 $\mathbf{f}_{\mathbf{X}} \mathbf{Q} = \Delta \mathbf{V} \cdot \mathbf{I} \cdot \mathbf{T}_{\mathrm{Total}}$

Open Calculator 🚰

- $\textbf{ex} \ 3024 \text{W} = 18 \text{V} \cdot 2.1 \text{A} \cdot 80 \text{s}$
- 11) Heat Energy given Electric Potential Difference and Resistance 🗗



Open Calculator

ex $1728W = (18V)^2 \cdot \frac{80s}{15\Omega}$



12) Heat Generated through Resistance

 $\mathbf{f}\mathbf{x} = \mathbf{I}^2 \cdot \mathbf{R} \cdot \mathbf{T}_{\mathrm{Total}}$

Open Calculator

 $\texttt{ex} \ 5292 \text{W} = (2.1 \text{A})^2 \cdot 15\Omega \cdot 80 \text{s}$

13) Power given Electric Current and Resistance

 $\mathbf{f}_{\mathbf{X}} [\mathrm{P} = \mathrm{I}^2 \cdot \mathrm{R}]$

Open Calculator

 $= 17.23857W = (.9577A)^2 \cdot 18.7950\Omega$

14) Power given Electric Potential Difference and Electric Current

fx $P = \Delta V \cdot I$

Open Calculator 🚰

 $16.99918W = 17.75V \cdot .9577A$

15) Power given Electric Potential Difference and Resistance

 $\mathbf{F} = rac{\Delta V^2}{R}$

Open Calculator

$$ext{ex} 16.7631 ext{W} = rac{\left(17.75 ext{V}
ight)^2}{18.7950 \Omega}$$



Open Calculator

Open Calculator

Open Calculator

Open Calculator

Resistance

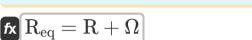
16) Equivalent Resistance in Parallel

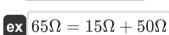
$$extbf{R}_{ ext{eq}} = \left(rac{1}{ ext{R}} + rac{1}{\Omega}
ight)^{-1}$$

$$\left(\frac{1}{R} + \frac{1}{\Omega}\right)$$

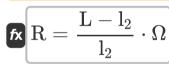
$$extbf{ex} \left[11.53846\Omega = \left(rac{1}{15\Omega} + rac{1}{50\Omega}
ight)^{-1}
ight]$$

17) Equivalent Resistance in Series 🗗





18) Internal Resistance using Potentiometer 🗗



$$ag{12.5\Omega} = rac{1500 ext{mm} - 1200 ext{mm}}{1200 ext{mm}} \cdot 50\Omega$$

19) Resistance
$$\mathbb{R} = \frac{\rho \cdot 1}{\Lambda}$$

$$ag{1.092857\Omega}=rac{0.017\Omega^* ext{mm}\cdot 0.9 ext{m}}{14 ext{mm}^2}$$





Open Calculator 2

Open Calculator

Open Calculator G

Open Calculator

20) Resistance of Wire

 $\left| \mathbf{f} \mathbf{x}
ight| \mathrm{R} =
ho \cdot \left| \frac{\mathrm{L}}{\Delta}
ight|$

 $1500 \mathrm{mm}$ ex $1.821429\Omega = 0.017\Omega*mm$. $14 \mathrm{mm}^2$

21) Resistance on Stretching of Wire

 $\left| \mathbf{R} \right| \mathbf{R} = rac{\Omega \cdot \mathbf{L}^2}{\left(\mathbf{l}_2
ight)^2}
ight|$

 $ag{78.125}\Omega = rac{50\Omega \cdot (1500 ext{mm})^2}{(1200 ext{mm})^2}$ 22) Resistivity of Material

 $ho = rac{2 \cdot [ext{Mass-e}]}{ ext{n} \cdot {[ext{Charge-e}]}^2 \cdot au}$

 $\mathbf{ex} \ 2\mathrm{E^11}\Omega^*\mathrm{mm} = rac{2\cdot[\mathrm{Mass-e}]}{7\cdot[\mathrm{Charge-e}]^2\cdot0.05\mathrm{s}}$

23) Temperature Dependence of Resistance 🗹

$\mathbf{K} = \mathrm{R}_{\mathrm{ref}} \cdot (1 + lpha \cdot \Delta \mathrm{T})$

ex $1602.5\Omega=2.5\Omega\cdot(1+16\,^\circ\mathrm{C}^{-_1}\cdot40\mathrm{K})$







Voltage and Current Measuring Instruments 🚰

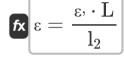
24) Current in Potentiometer

$$I = rac{\mathbf{x} \cdot \mathbf{L}}{\mathrm{R}}$$

Open Calculator 🖸

$$\boxed{114 \mathrm{A} = \frac{1140 \mathrm{V/m} \cdot 1500 \mathrm{mm}}{15\Omega}}$$

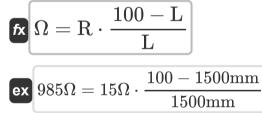
25) EMF of Unknown Cell using Potentiometer



Open Calculator

$$=$$
 $2.5 \text{V} = \frac{6 \text{V} \cdot 1500 \text{mm}}{1200 \text{mm}}$

26) Metre Bridge



Open Calculator

Open Calculator

fx
$$V = I \cdot R$$

ex
$$31.5\mathrm{V} = 2.1\mathrm{A} \cdot 15\Omega$$







28) Potential Difference through Voltmeter 🚰

fx $\Delta V = I_G \cdot R + I_G \cdot R_G$

Open Calculator

 $extbf{ex}$ $38.25 ext{V} = 1.5 ext{A} \cdot 15\Omega + 1.5 ext{A} \cdot 10.5\Omega$

29) Potential Gradient through Potentiometer

 $\mathbf{x} = rac{\Delta \mathrm{V} - \mathrm{V_B}}{\mathrm{L}}$

Open Calculator

 $0.666667 ext{V/m} = rac{18 ext{V} - 17 ext{V}}{1500 ext{mm}}$

30) Shunt in Ammeter

 $m R_{sh} = R_G \cdot rac{I_G}{I - I_G}$

Open Calculator 🗗

ex $26.25\Omega=10.5\Omega\cdotrac{1.5 ext{A}}{2.1 ext{A}-1.5 ext{A}}$



Variables Used

- ∆T Change in Temperature (Kelvin)
- A Cross-Sectional Area (Square Millimeter)
- Acond Area of Conductor (Square Millimeter)
- **E** Electric Field (Volt per Meter)
- e Number of Electrons
- I Electric Current (Ampere)
- | Electric Current (Ampere)
- I_G Electric Current through Galvanometer (Ampere)
- J Electric Current Density (Ampere per Square Millimeter)
- I Length of Conductor (Meter)
- L Length (Millimeter)
- 1₂ Final Length (Millimeter)
- n Number of Free Charge Particles per Unit Volume
- P Power (Watt)
- **q** Charge (Coulomb)
- Q Heat Rate (Watt)
- R Resistance (Ohm)
- R Resistance (Ohm)
- Reg Equivalent Resistance (Ohm)
- RG Resistance through Galvanometer (Ohm)
- Rref Resistance at Reference Temperature (Ohm)
- R_{sh} Shunt (Ohm)





- T_{Total} Total Time Taken (Second)
- V Voltage (Volt)
- **V**_B Electric Potential Diff through other Terminal (*Volt*)
- V_d Drift Speed (Millimeter per Second)
- Velectromotive Electromotive Voltage (Volt)
- X Potential Gradient (Volt per Meter)
- α Temperature Coefficient of Resistance (Per Degree Celsius)
- **ΔV** Electric Potential Difference (Volt)
- ΔV Electric Potential Difference (Volt)
- E Electromotive Force (Volt)
- ε EMF of Unknown Cell using Potentiometer (Volt)
- p Resistivity (Ohm Millimeter)
- **Ω** Final Resistance (Ohm)
- τ Relaxation time (Second)





Constants, Functions, Measurements used

- Constant: [Charge-e], 1.60217662E-19 Charge of electron
- Constant: [Mass-e], 9.10938356E-31 Mass of electron
- Measurement: Length in Meter (m), Millimeter (mm)
 Length Unit Conversion
- Measurement: Time in Second (s)
 Time Unit Conversion
- Measurement: Electric Current in Ampere (A)
 Electric Current Unit Conversion
- Measurement: Temperature in Kelvin (K)
 Temperature Unit Conversion
- Measurement: Area in Square Millimeter (mm²)
 Area Unit Conversion
- Measurement: Speed in Millimeter per Second (mm/s)
 Speed Unit Conversion
- Measurement: Electric Charge in Coulomb (C)
 Electric Charge Unit Conversion
- Measurement: Power in Watt (W)
 Power Unit Conversion
- Measurement: Electric Resistance in Ohm (Ω) Electric Resistance Unit Conversion
- Measurement: Surface Current Density in Ampere per Square Millimeter (A/mm²)
 - Surface Current Density Unit Conversion 💪





- Measurement: Electric Field Strength in Volt per Meter (V/m)

 Electric Field Strength Unit Conversion
- Measurement: Electric Potential in Volt (V)

 Electric Potential Unit Conversion
- Measurement: Electric Resistivity in Ohm Millimeter (Ω*mm)
 Electric Resistivity Unit Conversion
- Measurement: Temperature Coefficient of Resistance in Per Degree Celsius (°C⁻¹)

Temperature Coefficient of Resistance Unit Conversion





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