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Noise Pollution Formulas

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List of 31 Noise Pollution Formulas

Noise Pollution

Characteristics of Sound and its Measurements

1) Temperature in Kelvin given Speed of Sound

$$\text{fx } T = \left(\frac{C}{20.05} \right)^2$$

[Open Calculator !\[\]\(de95854c7ee024cfadc48187bbb781b2_img.jpg\)](#)

$$\text{ex } 292.6574\text{K} = \left(\frac{343\text{m/s}}{20.05} \right)^2$$

2) Wavelength of Wave

$$\text{fx } \lambda = \frac{C}{f}$$

[Open Calculator !\[\]\(6a9b39b98eb945faa14c645ec99e4eaa_img.jpg\)](#)

$$\text{ex } 0.599997\text{m} = \frac{343\text{m/s}}{571.67\text{Hz}}$$



Period and Frequency of Wave

3) Frequency given Period of Wave

$$fx \quad f = \frac{1}{T_p}$$

[Open Calculator !\[\]\(a03a7eb2f4046e1d3c76772003e549ea_img.jpg\)](#)

$$ex \quad 571.4286\text{Hz} = \frac{1}{0.00175\text{s}}$$

4) Frequency given Wavelength of Wave

$$fx \quad f = \frac{C}{\lambda}$$

[Open Calculator !\[\]\(5361750c22c4e047a52f4eac1ec2d4cc_img.jpg\)](#)

$$ex \quad 571.6667\text{Hz} = \frac{343\text{m/s}}{0.6\text{m}}$$

5) Period of Wave

$$fx \quad T_p = \frac{1}{f}$$

[Open Calculator !\[\]\(b792654f2cef9719eabeb6c5be00811e_img.jpg\)](#)

$$ex \quad 0.001749\text{s} = \frac{1}{571.67\text{Hz}}$$



Root Mean Square Pressure

6) Root Mean Square Pressure given Sound Intensity

$$fx \quad P_{\text{rms}} = \sqrt{I \cdot \rho \cdot C}$$

[Open Calculator !\[\]\(23d9fc146e83b5c3013cfa32c784f8d5_img.jpg\)](#)

$$ex \quad 0.000211\text{Pa} = \sqrt{1\text{E}^{-10}\text{W}/\text{m}^2 \cdot 1.293\text{kg}/\text{m}^3 \cdot 343\text{m}/\text{s}}$$

7) Root Mean Square Pressure when Sound Pressure Level

$$fx \quad P_m = (20 \cdot 10^{-6}) \cdot 10^{\frac{L}{20}}$$

[Open Calculator !\[\]\(aa53ad6fea213b8b2226d3077e30533a_img.jpg\)](#)

$$ex \quad 200\mu\text{Pa} = (20 \cdot 10^{-6}) \cdot 10^{\frac{20\text{dB}}{20}}$$

Sound Intensity

8) Density of Air given Sound Intensity

$$fx \quad \rho = \frac{P_{\text{rms}}^2}{I \cdot C}$$

[Open Calculator !\[\]\(a8f9309f944226d1420f5fed22e2b6e6_img.jpg\)](#)

$$ex \quad 1.285714\text{kg}/\text{m}^3 = \frac{(0.00021\text{Pa})^2}{1\text{E}^{-10}\text{W}/\text{m}^2 \cdot 343\text{m}/\text{s}}$$


9) Power of Sound Wave given Sound Intensity

$$fx \quad W = I \cdot A$$

[Open Calculator !\[\]\(cbd8541a32dfc32f356f5c6c994b0a21_img.jpg\)](#)

$$ex \quad 1.4\text{E}^{-9}\text{W} = 1\text{E}^{-10}\text{W}/\text{m}^2 \cdot 14\text{m}^2$$



10) Sound Intensity 

$$fx \quad I = \frac{W}{A}$$

Open Calculator 


$$ex \quad 1E^{-10}W/m^2 = \frac{1.4E^{-9}W}{14m^2}$$

11) Sound Intensity Level 

$$fx \quad L = 10 \cdot \log_{10} \left(\frac{I}{10^{-12}} \right)$$

Open Calculator 

$$ex \quad 20dB = 10 \cdot \log_{10} \left(\frac{1E^{-10}W/m^2}{10^{-12}} \right)$$

12) Sound Intensity using Sound Intensity Level 

$$fx \quad I = (10^{-12}) \cdot 10^{\frac{L}{10}}$$

Open Calculator 

$$ex \quad 1E^{-10}W/m^2 = (10^{-12}) \cdot 10^{\frac{20dB}{10}}$$


13) Sound Intensity with respect to Sound Pressure 

$$fx \quad I = \left(\frac{P_{rms}^2}{\rho \cdot C} \right)$$

Open Calculator 

$$ex \quad 9.9E^{-11}W/m^2 = \left(\frac{(0.00021Pa)^2}{1.293kg/m^3 \cdot 343m/s} \right)$$



14) Unit Area given Sound Intensity 

$$fx \quad A = \frac{W}{I}$$

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0_img.jpg\)](#)

$$ex \quad 14m^2 = \frac{1.4E^{-9}W}{1E^{-10}W/m^2}$$

Sound Pressure 15) Barometric Pressure given Sound Pressure 

$$fx \quad P_b = P_{atm} - P_s$$

[Open Calculator !\[\]\(73002692dd5e7a64e60946be3158e719_img.jpg\)](#)

$$ex \quad 100525Pa = 101325Pa - 800Pa$$

16) Sound Pressure 

$$fx \quad P_s = P_{atm} - P_b$$

[Open Calculator !\[\]\(104fbf564e2e5a8fbd84f31656d114c7_img.jpg\)](#)

$$ex \quad 800Pa = 101325Pa - 100525Pa$$

17) Sound Pressure Level in Decibels (Root Mean Square Pressure) 

$$fx \quad L = 20 \cdot \log_{10} \left(\frac{P_m}{20 \cdot 10^{-6}} \right)$$

[Open Calculator !\[\]\(21226b58c700e5231ab98d27101bac58_img.jpg\)](#)

$$ex \quad 20dB = 20 \cdot \log_{10} \left(\frac{200\mu Pa}{20 \cdot 10^{-6}} \right)$$



18) Total Atmospheric Pressure given Sound Pressure 

$$fx \quad P_{\text{atm}} = P_s + P_b$$

[Open Calculator !\[\]\(9dfdaff1d86ba3c1f8353b4d1b61b8c5_img.jpg\)](#)

$$ex \quad 101325\text{Pa} = 800\text{Pa} + 100525\text{Pa}$$

Velocity of Sound 19) Speed of Sound Wave 

$$fx \quad C = 20.05 \cdot \sqrt{T}$$

[Open Calculator !\[\]\(3cb60d42b10e53f9522bb0b392c1c4cd_img.jpg\)](#)


$$ex \quad 342.9957\text{m/s} = 20.05 \cdot \sqrt{292.65\text{K}}$$

20) Velocity for Wavelength of Wave 

$$fx \quad C = (\lambda \cdot f)$$

[Open Calculator !\[\]\(0d7ca0919e6c47bbd874bfa0189fe22e_img.jpg\)](#)

$$ex \quad 343.002\text{m/s} = (0.6\text{m} \cdot 571.67\text{Hz})$$

21) Velocity of Sound Wave given Sound Intensity 

$$fx \quad C = \frac{P_{\text{rms}}^2}{I \cdot \rho}$$

[Open Calculator !\[\]\(683dba75afe26e28cd4de5730b776760_img.jpg\)](#)

$$ex \quad 341.0673\text{m/s} = \frac{(0.00021\text{Pa})^2}{1\text{E}^{-10}\text{W/m}^2 \cdot 1.293\text{kg/m}^3}$$



Levels of Noise

22) Sound Intensity given Sound Level in Bels

$$fx \quad I = I_o \cdot 10^{L_b}$$

[Open Calculator !\[\]\(96cc62f861fdd6e50510c0224a756dff_img.jpg\)](#)

$$ex \quad 1E^{-10}W/m^2 = 1E^{-12}W/m^2 \cdot 10^{0.2B}$$

23) Sound Intensity given Sound Level in Decibels

$$fx \quad I = (I_o) \cdot 10^{\frac{L}{10}}$$

[Open Calculator !\[\]\(f95dab70c751fda7d824b8b03650f7aa_img.jpg\)](#)

$$ex \quad 1E^{-10}W/m^2 = (1E^{-12}W/m^2) \cdot 10^{\frac{20dB}{10}}$$

24) Sound Level in Bels

$$fx \quad L_b = \log_{10} \left(\frac{I}{I_o} \right)$$

[Open Calculator !\[\]\(e9474ce1d70442456f8fe9c393ea149c_img.jpg\)](#)

$$ex \quad 0.2B = \log_{10} \left(\frac{1E^{-10}W/m^2}{1E^{-12}W/m^2} \right)$$

25) Sound Level in Decibels

$$fx \quad L = 10 \cdot \log_{10} \left(\frac{I}{I_o} \right)$$

[Open Calculator !\[\]\(9db214d549b9aeebe72aa11d3a5c4b1a_img.jpg\)](#)

$$ex \quad 20dB = 10 \cdot \log_{10} \left(\frac{1E^{-10}W/m^2}{1E^{-12}W/m^2} \right)$$




26) Standard Sound Intensity given Sound Level in Bels 

$$fx \quad I_o = \frac{I}{10^{L_b}}$$

[Open Calculator !\[\]\(c3d993ca47bfe2a953c700506ce31fa0_img.jpg\)](#)


$$ex \quad 1E^{-12}W/m^2 = \frac{1E^{-10}W/m^2}{10^{0.2B}}$$

27) Standard Sound Intensity given Sound Level in Decibels 

$$fx \quad I_o = \frac{I}{10^{\frac{L}{10}}}$$

[Open Calculator !\[\]\(17413706fd4997a1a4bdf85c6864eee1_img.jpg\)](#)

$$ex \quad 1E^{-12}W/m^2 = \frac{1E^{-10}W/m^2}{10^{\frac{20dB}{10}}}$$

Noise Abatement and Control 28) Distance between Source and Barrier given Noise Reduction in Decibels 

$$fx \quad R = \frac{20 \cdot h_w^2}{\lambda \cdot 10^{\frac{N}{10}}}$$

[Open Calculator !\[\]\(95b425611cbd2b8716a140cf67c81822_img.jpg\)](#)

$$ex \quad 1.012983m = \frac{20 \cdot (3.1m)^2}{0.6m \cdot 10^{\frac{25dB}{10}}}$$



29) Height of Barrier Wall given Noise Reduction in Decibels

[Open Calculator !\[\]\(99f58673407353e96a019fbca558fd72_img.jpg\)](#)

$$fx \quad h_w = \sqrt{\left(\frac{\lambda \cdot R}{20}\right) \cdot 10^{\frac{N}{10}}}$$

$$ex \quad 3.095432m = \sqrt{\left(\frac{0.6m \cdot 1.01m}{20}\right) \cdot 10^{\frac{25dB}{10}}}$$

30) Noise Reduction in Decibels

[Open Calculator !\[\]\(de95854c7ee024cfadc48187bbb781b2_img.jpg\)](#)

$$fx \quad N = 10 \cdot \log 10 \left(\frac{20 \cdot h_w^2}{\lambda \cdot R} \right)$$

$$ex \quad 25.01281dB = 10 \cdot \log 10 \left(\frac{20 \cdot (3.1m)^2}{0.6m \cdot 1.01m} \right)$$

31) Wavelength of Sound given Noise Reduction in Decibels

[Open Calculator !\[\]\(6a9b39b98eb945faa14c645ec99e4eaa_img.jpg\)](#)

$$fx \quad \lambda = \frac{20 \cdot h_w^2}{R \cdot 10^{\frac{N}{10}}}$$

$$ex \quad 0.601772m = \frac{20 \cdot (3.1m)^2}{1.01m \cdot 10^{\frac{25dB}{10}}}$$












Variables Used




- **A** Area for Sound Intensity (Square Meter)
- **C** Velocity of Sound Wave (Meter per Second)
- **f** Frequency of Sound Wave (Hertz)
- **h_w** Height of the Barrier Wall (Meter)
- **I** Sound Intensity Level (Watt per Square Meter)
- **I_o** Standard Sound Intensity (Watt per Square Meter)
- **L** Sound Level in Decibels (Decibel)
- **L_b** Sound Level in Bels (Bel)
- **N** Noise Reduction (Decibel)
- **P_{atm}** Total Atmospheric Pressure (Pascal)
- **P_b** Barometric Pressure (Pascal)
- **P_m** Pressure RMS in Micropascal (Micropascal)
- **P_{rms}** Pressure RMS (Pascal)
- **P_s** Pressure (Pascal)
- **R** Horizontal Distance (Meter)
- **T** Temperature (Kelvin)
- **T_p** Time Period of Sound Wave (Second)
- **W** Sound Power (Watt)
- **λ** Wavelength of Sound Wave (Meter)
- **ρ** Density of Air (Kilogram per Cubic Meter)



Constants, Functions, Measurements used

- **Function: log₁₀**, log₁₀(Number)
The common logarithm, also known as the base-10 logarithm or the decimal logarithm, is a mathematical function that is the inverse of the exponential function.
- **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.
- **Measurement: Length** in Meter (m)
Length Unit Conversion 
- **Measurement: Time** in Second (s)
Time Unit Conversion 
- **Measurement: Temperature** in Kelvin (K)
Temperature Unit Conversion 
- **Measurement: Area** in Square Meter (m²)
Area Unit Conversion 
- **Measurement: Pressure** in Pascal (Pa), Micropascal (μPa)
Pressure Unit Conversion 
- **Measurement: Speed** in Meter per Second (m/s)
Speed Unit Conversion 
- **Measurement: Power** in Watt (W)
Power Unit Conversion 
- **Measurement: Frequency** in Hertz (Hz)
Frequency Unit Conversion 
- **Measurement: Wavelength** in Meter (m)
Wavelength Unit Conversion 



- **Measurement: Density** in Kilogram per Cubic Meter (kg/m^3)
Density Unit Conversion 
- **Measurement: Sound** in Decibel (dB), Bel (B)
Sound Unit Conversion 
- **Measurement: Intensity** in Watt per Square Meter (W/m^2)
Intensity Unit Conversion 



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