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Doppler Effect and Wavelength Changes Formulas

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List of 15 Doppler Effect and Wavelength Changes Formulas

Doppler Effect and Wavelength Changes

Doppler Effect

1) Observed Frequency when Observer and Source Move Away from Each Other

$$fx \quad F_o = \left(\frac{f_w \cdot (c - V_o)}{c + V_{source}} \right)$$

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

$$ex \quad 28.36879Hz = \left(\frac{200Hz \cdot (343m/s - 283m/s)}{343m/s + 80m/s} \right)$$

2) Observed Frequency when Observer and Source Move towards Each Other

$$fx \quad F_o = \left(\frac{f_w \cdot (c + V_o)}{c - V_{source}} \right)$$

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

$$ex \quad 476.0456Hz = \left(\frac{200Hz \cdot (343m/s + 283m/s)}{343m/s - 80m/s} \right)$$



3) Observed Frequency when Observer Moves Away from Source

$$\text{fx } F_o = f_w \cdot \left(\frac{c - V_o}{c} \right)$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$\text{ex } 34.98542\text{Hz} = 200\text{Hz} \cdot \left(\frac{343\text{m/s} - 283\text{m/s}}{343\text{m/s}} \right)$$

4) Observed Frequency when Observer Moves Away from Source using Wavelength

$$\text{fx } F_o = \frac{c - V_o}{\lambda}$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$\text{ex } 150\text{Hz} = \frac{343\text{m/s} - 283\text{m/s}}{0.4\text{m}}$$

5) Observed Frequency when Observer Moves towards Source

$$\text{fx } F_o = \left(\frac{c + V_o}{c} \right) \cdot f_w$$

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

$$\text{ex } 365.0146\text{Hz} = \left(\frac{343\text{m/s} + 283\text{m/s}}{343\text{m/s}} \right) \cdot 200\text{Hz}$$



6) Observed Frequency when Observer Moves towards Source and Source Moves Away

$$\text{fx } F_o = \left(\frac{c + V_o}{c + V_{\text{source}}} \right) \cdot f_w$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$\text{ex } 295.9811\text{Hz} = \left(\frac{343\text{m/s} + 283\text{m/s}}{343\text{m/s} + 80\text{m/s}} \right) \cdot 200\text{Hz}$$

7) Observed Frequency when Observer Moves towards Source using Wavelength

$$\text{fx } F_o = \frac{c + V_o}{\lambda}$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

$$\text{ex } 1565\text{Hz} = \frac{343\text{m/s} + 283\text{m/s}}{0.4\text{m}}$$

8) Observed Frequency when Source Moves Away from Observer

$$\text{fx } F_o = f_w \cdot \frac{c}{c + V_{\text{source}}}$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

$$\text{ex } 162.1749\text{Hz} = 200\text{Hz} \cdot \frac{343\text{m/s}}{343\text{m/s} + 80\text{m/s}}$$



9) Observed Frequency when Source Moves towards Observer

$$\text{fx } F_o = f_W \cdot \frac{c}{c - V_{\text{source}}}$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

$$\text{ex } 260.8365\text{Hz} = 200\text{Hz} \cdot \frac{343\text{m/s}}{343\text{m/s} - 80\text{m/s}}$$

10) Observed Frequency when Source Moves towards Observer and Observer Moves Away

$$\text{fx } F_o = \left(\frac{f_W \cdot (c - V_o)}{c - V_{\text{source}}} \right)$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

$$\text{ex } 45.62738\text{Hz} = \left(\frac{200\text{Hz} \cdot (343\text{m/s} - 283\text{m/s})}{343\text{m/s} - 80\text{m/s}} \right)$$

Wavelength Changes

11) Change in Wavelength due to Movement of Source

$$\text{fx } \lambda = V_{\text{source}} \cdot T_W$$

[Open Calculator !\[\]\(0fb13ad0bfa3d86868cdd3883e5665b3_img.jpg\)](#)

$$\text{ex } 0.4\text{m} = 80\text{m/s} \cdot 0.005\text{s}$$

12) Change in Wavelength given Angular Frequency

$$\text{fx } \lambda = 2 \cdot \pi \cdot V_{\text{source}} \cdot \omega_f$$

[Open Calculator !\[\]\(e50091943b385fe16d3277389202856f_img.jpg\)](#)

$$\text{ex } 0.402124\text{m} = 2 \cdot \pi \cdot 80\text{m/s} \cdot 0.0008\text{Hz}$$



13) Change in Wavelength given Frequency

$$\text{fx } \lambda = \frac{V_{\text{source}}}{f_W}$$

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

$$\text{ex } 0.4\text{m} = \frac{80\text{m/s}}{200\text{Hz}}$$

14) Effective Wavelength when Source Moves Away from Observer

$$\text{fx } \lambda_{\text{effective}} = \frac{c + V_{\text{source}}}{f_W}$$

[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5_img.jpg\)](#)

$$\text{ex } 2.115\text{m} = \frac{343\text{m/s} + 80\text{m/s}}{200\text{Hz}}$$

15) Effective Wavelength when Source Moves towards Observer

$$\text{fx } \lambda_{\text{effective}} = \frac{c - V_{\text{source}}}{f_W}$$

[Open Calculator !\[\]\(ab4e2b3fc7e7887b7a72f548aa6f5e60_img.jpg\)](#)

$$\text{ex } 1.315\text{m} = \frac{343\text{m/s} - 80\text{m/s}}{200\text{Hz}}$$







Variables Used

- **c** Velocity of Sound (Meter per Second)
- **F_o** Frequency Observed (Hertz)
- **f_w** Wave Frequency (Hertz)
- **T_w** Time Period of Progressive Wave (Second)
- **V_o** Velocity Observed (Meter per Second)
- **V_{source}** Velocity of Source (Meter per Second)
- **λ** Wavelength (Meter)
- **λ_{effective}** Effective Wavelength (Meter)
- **ω_f** Angular Frequency (Hertz)






Constants, Functions, Measurements used

- **Constant:** **pi**, 3.14159265358979323846264338327950288
Archimedes' constant
- **Measurement:** **Length** in Meter (m)
Length Unit Conversion 
- **Measurement:** **Time** in Second (s)
Time Unit Conversion 
- **Measurement:** **Speed** in Meter per Second (m/s)
Speed Unit Conversion 
- **Measurement:** **Frequency** in Hertz (Hz)
Frequency Unit Conversion 



Check other formula lists

- **Doppler Effect and Wavelength Changes Formulas** 
- **Wave Properties and Equations Formulas** 
- **Sound Propagation and Resonance Formulas** 

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