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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

Open Calculator

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

ex $$14.09929\text{Hz} = \left(\frac{200\text{Hz} \cdot (343\text{m/s} - 313.18\text{m/s})}{343\text{m/s} + 80\text{m/s}} \right)$$

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

Open Calculator

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

ex $$498.9962\text{Hz} = \left(\frac{200\text{Hz} \cdot (343\text{m/s} + 313.18\text{m/s})}{343\text{m/s} - 80\text{m/s}} \right)$$

3) Observed Frequency when Observer Moves Away from Source

Open Calculator

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

ex $$17.38776\text{Hz} = 200\text{Hz} \cdot \left(\frac{343\text{m/s} - 313.18\text{m/s}}{343\text{m/s}} \right)$$

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

Open Calculator

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

ex $$74.55\text{Hz} = \frac{343\text{m/s} - 313.18\text{m/s}}{0.4\text{m}}$$

5) Observed Frequency when Observer Moves towards Source

Open Calculator

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

ex $$382.6122\text{Hz} = \left(\frac{343\text{m/s} + 313.18\text{m/s}}{343\text{m/s}} \right) \cdot 200\text{Hz}$$

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

Open Calculator

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

$$310.2506\text{Hz} = \left(\frac{343\text{m/s} + 313.18\text{m/s}}{343\text{m/s} + 80\text{m/s}} \right) \cdot 200\text{Hz}$$

7) Observed Frequency when Observer Moves towards Source using Wavelength

Open Calculator

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

$$1640.45\text{Hz} = \frac{343\text{m/s} + 313.18\text{m/s}}{0.4\text{m}}$$

8) Observed Frequency when Source Moves Away from Observer

Open Calculator

$$F_o = f_W \cdot \frac{c}{c + V_{source}}$$

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

9) Observed Frequency when Source Moves towards Observer

Open Calculator

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

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

Open Calculator

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

ex $$22.67681\text{Hz} = \left(\frac{200\text{Hz} \cdot (343\text{m/s} - 313.18\text{m/s})}{343\text{m/s} - 80\text{m/s}} \right)$$

Wavelength Changes

11) Change in Wavelength due to Movement of Source

Open Calculator

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

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

12) Change in Wavelength given Angular Frequency

Open Calculator

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

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

13) Change in Wavelength given Frequency

Open Calculator

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

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

14) Effective Wavelength when Source Moves Away from Observer

Open Calculator

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

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

Open Calculator

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

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)*
- $\lambda_{effective}$ 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**
- **Sound Propagation and Resonance Formulas**
- **Wave Properties and Equations Formulas**

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