Basics of Noise and Its Measurement

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Nature of Sound

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Reflection

Rarefaction

Interference (beats)

Diffraction

Dispersion

Absorption, transmission
Example of Beats
Beats

Two Sine Waves Superimposed

Magnitude

Time

0 100 200 300 400 500 600 700 800 900 1000
Beats

Beat Waveform
Nature of Sound

\[ P_{total} = P_o + \rho \]

\[ P_o = 1,01,325 \text{ Pa} \]
## Typical Sound Pressures

<table>
<thead>
<tr>
<th>Source</th>
<th>Pressure (Pa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Krakatoa explosion at 160 km</td>
<td>20,000 Pa (RMS)</td>
</tr>
<tr>
<td>.30-06 rifle -1 m to shooter's side</td>
<td>7,265</td>
</tr>
<tr>
<td>Jet engine at 30 m</td>
<td>632</td>
</tr>
<tr>
<td>Threshold of pain</td>
<td>63.2</td>
</tr>
<tr>
<td>Hearing damage possible</td>
<td>20</td>
</tr>
<tr>
<td>Jet at 100 m</td>
<td>6.32 – 200</td>
</tr>
<tr>
<td>Hearing damage (long-term exposure)</td>
<td>0.356</td>
</tr>
<tr>
<td>Passenger car at 10 m</td>
<td>0.02 – 0.20</td>
</tr>
<tr>
<td>TV (set at home level) at 1 m</td>
<td>0.02</td>
</tr>
<tr>
<td>Normal talking at 1 m</td>
<td>0.002 – 0.02</td>
</tr>
<tr>
<td>Very calm room</td>
<td>$6.32 \times 10^{-4}$</td>
</tr>
<tr>
<td>Leaves rustling, calm breathing</td>
<td>$6.32 \times 10^{-5}$</td>
</tr>
<tr>
<td>Auditory threshold at 1 kHz</td>
<td>$2 \times 10^{-5}$</td>
</tr>
</tbody>
</table>

Pressure due to a currency coin on table = 97 Pa

The Need for Logarithmic Scales

- Audible sound pressure ranges from $2 \times 10^4$ Pa to $2 \times 10^{-5}$ Pa

- Therefore *logarithmic scales* are preferred in order to represent the entire audible pressure range.
Measuring Sound

Source

Medium/Path

Receiver

Power (W)

Intensity (W/m²)

Pressure (Pa)
References


