

Sound Intensity and the Decibel System

Read from **Lesson 2** of the **Sound and Music** chapter at **The Physics Classroom**:

<http://www.physicsclassroom.com/Class/sound/u11l2b.html>

MOP Connection: Sound and Music: sublevel 3

1. The decibel system is a system used to express the intensity of a sound. It is based on the powers of 10. A decibel is 1/10-th of a Bel. The sound level in Bels describes the power on 10 by which that sound is more intense than the so-called *threshold of hearing* (TOH). A 1-Bel sound is 10^1 times more intense than the TOH; it is a 10-decibel sound. A 2-Bel sound is 10^2 times more intense than the TOH; it is a 20-decibel sound. Use your understanding of the powers of 10 to complete the following table. (NOTE: different literature sources cite different intensity levels.)

Description of Sound	Intensity (W/m ²)	Sound Level (Bels)	Sound Level (decibels)
Threshold of Hearing	1×10^{-12}	0	0
Broadcasting Studio	1×10^{-10}	2	20
Mosquito Buzzing	1×10^{-8}		
Normal Conversation	1×10^{-6}		
Vacuum Cleaner	1×10^{-5}		
Busy Traffic	1×10^{-4}		
Power Mower or Thunder	1×10^{-2}		
Twisted Sister Rock Band (Mr. H's favorite)	1×10^{-1}		
Threshold of Pain	1		
Jackhammer or Nearby Plane (18')	1×10^1		
Explosions	1×10^2		

2. Compare the decibel level of the following sounds.
- If Sound B is 10 times the intensity of Sound A, then its decibel level is _____ higher.
 - If Sound C is 100 times the intensity of Sound A, then its decibel level is _____ higher.
 - If Sound D is 1000 times the intensity of Sound A, then its decibel level is _____ higher.
 - If Sound E is 10000 times the intensity of Sound A, then its decibel level is _____ higher.
3. How many times more intense is a
- ... a 30 dB sound than a 20 dB sound? 10^x where $x =$ _____ or _____
 - ... a 40 dB sound than a 20 dB sound? 10^x where $x =$ _____ or _____
 - ... an 80 dB sound than a 20 dB sound? 10^x where $x =$ _____ or _____
 - ... an 80 dB sound than a 50 dB sound? 10^x where $x =$ _____ or _____
 - ... a 92 dB sound than a 62 dB sound? 10^x where $x =$ _____ or _____