

EXAMEN : Baccalauréat général - Série S-SVT ou S-SI	Session 2014
ÉPREUVE : Évaluation spécifique de Langue en section européenne	
PHYSIQUE-CHIMIE en langue ANGLAISE	
Thème : "Ondes et matière"	Sujet n°12

Decibels and Phons

The rate at which sound energy reaches a given cross-sectional area is known as the **sound intensity**. Intensity values and decibels rating for several sound sources are listed in Table 1.

The decibels scale and the intensity values on which it is based on is an objective measure of a sound. While intensities and decibels (dB) are measurable, the loudness of a sound is subjective. Sound loudness varies from person to person. Furthermore, sounds with equal intensities but different frequencies are perceived by the same person to have unequal loudness. For instance, a 60 dB sound with a frequency of 1000 Hz sounds louder than a 60 dB sound with a frequency of 500 Hz. The unit **phon** is used to indicate an individual's perception of loudness. By definition, 1 phon is equivalent to 1 decibel at 1000 Hz (1 kHz).

Table 1: deciBel Ratings of Several Sounds

Sound Source	Intensity	deciBel
Weakest Sound Heard	$1 \times 10^{-12} \text{ W/m}^2$	0.0
Rustling Leaves	$1 \times 10^{-11} \text{ W/m}^2$	10.0
Quiet Library	$1 \times 10^{-9} \text{ W/m}^2$	30.0
Average Home	$1 \times 10^{-7} \text{ W/m}^2$	50.0
Normal Conversation	$1 \times 10^{-6} \text{ W/m}^2$	60.0
Phone Dial Tone	$1 \times 10^{-4} \text{ W/m}^2$	80.0
Truck Traffic	$1 \times 10^{-3} \text{ W/m}^2$	90.0
Chainsaw, 1 m away	$1 \times 10^{-1} \text{ W/m}^2$	110.0

Figure 1: Equal Loudness Curves

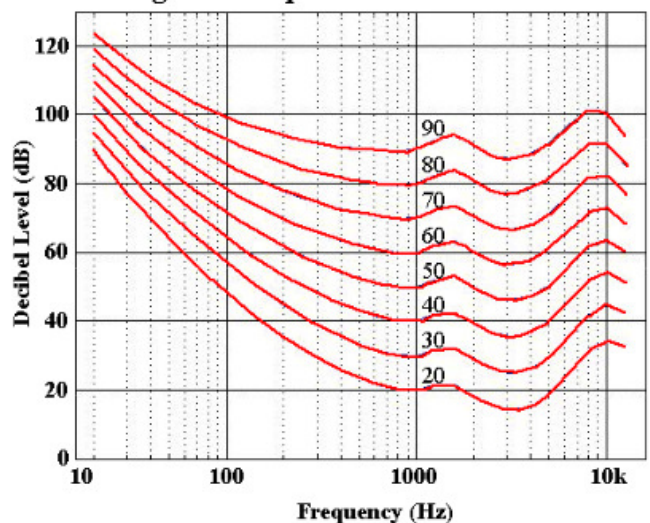


Figure 1 shows several equal loudness curves. The curves were determined experimentally. Volunteers were subjected to 1 kHz sound at 60 dB ; this is a *loudness* of 60 phon. Sounds with different frequencies were then played ; the volunteer adjusted the decibel level until it was perceived to have the same loudness as it had at 1000 Hz. This was repeated for varying frequencies to generate the entire 60-phon curve. [...]

From : <http://www.physicsclassroom.com/getattachment/actprep/act9ag.pdf>

Questions :

- 1) Present and comment on this document.
- 2) Do not forget to focus on at least one physics and/or chemistry topic as for example the sound level and the audible frequencies.
- 3) Do you know other properties of wave that are useful in our daily life ?