! Answers "Tonmeistertest" 73 - English

1. A home cinema system has five full-range speakers. Each of the five speakers produce a sound pressure level of 80 dB at the listening position. How much is the sum total sound pressure level at the listening position?

$$L_\Sigma = 10 \cdot \log_{10}\left(10^{\frac{L_1}{10}} + 10^{\frac{L_2}{10}} + \cdots + 10^{\frac{L_n}{10}}\right) \text{ dB}$$
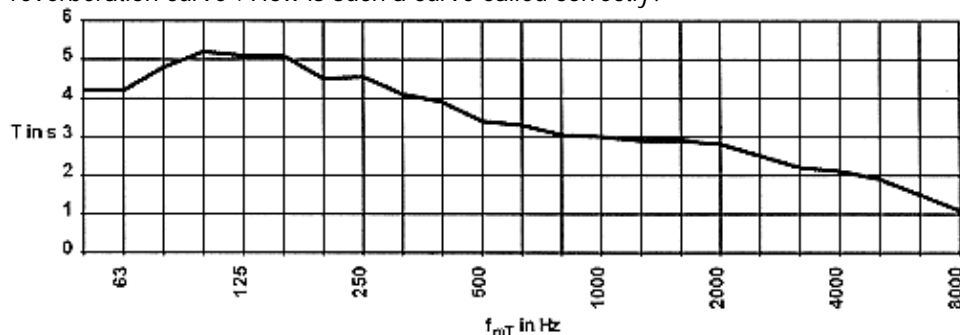
Level difference $\Delta L = 10 \times \log(5) = 7$ dB.   The sum of all level at the listening position is $L_\Sigma = 80$ dB + 7 dB = 87 dB.
See: Acoustic level addition: http://www.sengpielaudio.com/Rechner-spl.htm

2. The reverberation time is defined as the time interval within which the sound level has decreased by 60 dB in a room with sudden silence. **a)** How much of the initial sound pressure value is the sound pressure dropped? **b)** How much of the initial sound intensity value is the sound intensity dropped?

a) The sound pressure is dropped to the thousandth part. **b)** The sound intensity is dropped to the millionth part.

3. Here is a "reverberation curve". How is such a curve called correctly?

This is the "Reverberation time T60 in dependence of the frequency f". **Note:** This is not a frequency response of a concert hall.

4. What is a frequency response?

A frequency response describes the behaviour of a linear time-invariant system as a dependence of frequency; like a speaker or a filter in the analogue technology.

In this case, the respective amplitude ratio (in dB) is applied over the frequency, but also the respective phase position is possible. This is called amplitude (magnitude) frequency response or as phase transition or phase frequency response.

5. What math is related to speed of sound, frequency and wavelength of the sound?
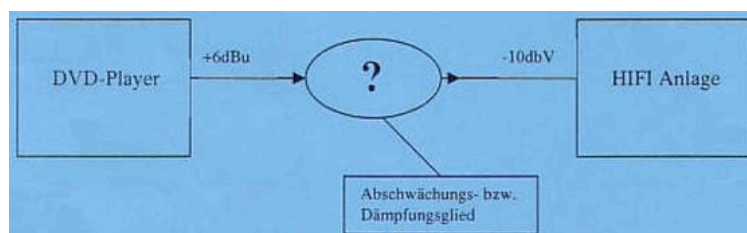
The speed of sound is frequency multiplied by wavelength $c = f \times \lambda$.

6. Why does the intonation of wind instruments get lower with decreasing air temperature?

Because the speed of sound is changed by temperature. At low temperature, the speed of sound is slower. The following applies to sound engineers with sufficient accuracy for the speed of sound in air c in m/s depending on the temperature ϑ in °C: $c = 331 + 0.6 \times \vartheta$ in m/s.
The frequency $f = c / \lambda$. Thus the pitch of all wind instruments goes down by decreasing temperature.

7. A professional DVD player with a maximum output level of +6 dBu shows audible distortions when connected to a stereo equipment because the input of the system is overloaded. The maximum input level must be less than –10 dBV. **a)** By what factor the voltage of the DVD player must be dampened to get the correct level? **b)** By how many decibels is the output signal of the DVD player too high?

+6 dBu correspond to 1.55 volts RMS and –10 dBV correspond to 0.316 volts RMS.
a) The voltage must be dampened by the factor 1.55/0.316 = 4.9. That means **b)** (–) 13.8 dB.