

• Noise-pollution

• Introduction -

- Noise is something unwanted, unpleasant sound that causes discomfort for all living beings.
- Exposure to loud & intense sound for prolonged period cause temporary hearing loss to permanent health disorder such as Headache, nausea, Insomnia, Vomiting coma & death.

• How noise is measured?

- Intensity of sound is measured in terms of pressure & expressed in Decibel (dB).

$$\text{Sound pressure level (SPL)} = 20 \log_{10} \left(\frac{P}{P_0} \right)$$

(L)

$P_0 \rightarrow$ Reference pressure, $P =$ air pressure

Note:- If pressure $> 20 \mu\text{Pa}$, then it produce sounds which are audible.

• Total Sound pressure level -

- L_1, L_2, \dots, L_n be the sounds produced by different sound sources $1, 2, \dots, n$ respectively at a place then total sound pressure level produced by them.

$$\text{TSPL} = 20 \log_{10} \left(\frac{P_{\text{rms}}}{P_0} \right)$$

$$P_{\text{rms}} = \sqrt{P_1^2 + P_2^2 + P_3^2 + \dots + P_n^2}$$

$$L_1 = 20 \log_{10} \left(\frac{P_1}{P_0} \right)$$

Que. 1 → The equivalent sound power level (in dB) of the four sources with the noise levels of 60 dB, 69 dB, 70 dB, & 79 dB is?

$$L_1 = 20 \log_{10} \left(\frac{P_1}{P_0} \right) = 60$$

$$\frac{P_1}{P_0} = 10^{L_1/20}$$

$$\frac{P_1}{P_0} = 10^3$$

$$\frac{P_2}{P_0} = 10^{69/20}$$

$$\frac{P_3}{P_0} = 10^{70/20}$$

$$\frac{P_4}{P_0} = 10^{79/20}$$

$$P_{rms} = \sqrt{P_1^2 + P_2^2 + P_3^2 + P_4^2}$$

$$P_{rms} = P_0 \sqrt{(10^3)^2 + (10^{69/20})^2 + (10^{70/20})^2 + (10^{79/20})^2}$$

$$P_{rms} = 20 \log_{10} (\text{---})$$

$$P_{rms} = 79.928 \text{ dB}$$

Shortcut

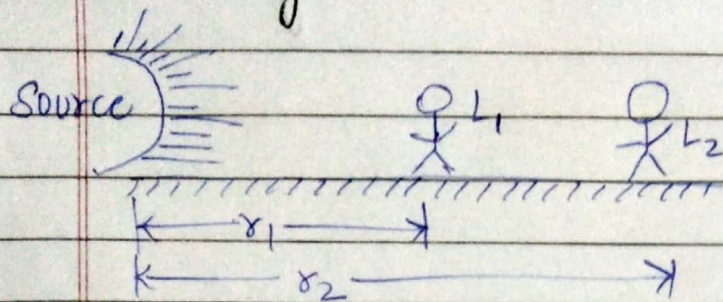
$$L_1, L_2, \dots$$

$$L_1 > L_2$$

$$L_T = L_1 + \alpha$$

$L_1 - L_2$	α
0-1	3
2-3	2
4-8	1
≥ 9	0

que. 2 → A generator emitting 80 dB noise at a distance 20m away from it. If the diameter is double, noise level at that location is?



$$L_2 = L_1 - 20 \log_{10} \left(\frac{r_2}{r_1} \right)$$

$$L_2 = 80 - 20 \log_{10} (2)$$

$$L_2 = 74 \text{ dB}$$

• Average Sound pressure level-

A source emitting different sounds L_1, L_2, \dots, L_n @ different time period. The avg. sound produced by the source is -

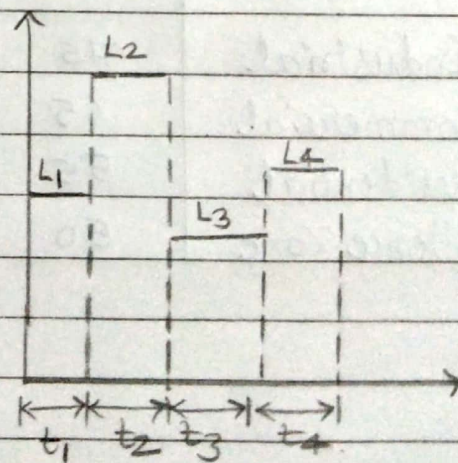
$$L_{\text{avg.}} = 20 \log_{10} \left(\frac{1}{N} 10^{L_i/20} \right)$$

N = no. of observations.

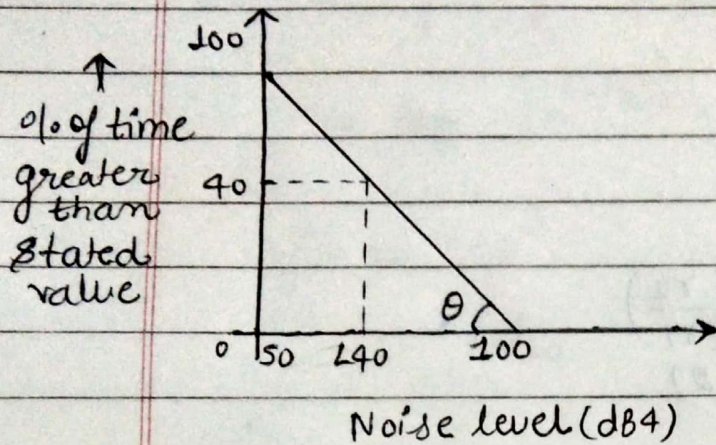
• Equivalent Sound pressure level-

$$L_{\text{eq.}} = 10 \log_{10} \left(\sum \left(10^{L_i/10} \times T_i \right) \right)$$

$$T_i = \frac{t_i}{\sum t}$$



que. → The cumulative noise power distribution curve at a certain location is given below. The value of L_{40} is equal to ?



[Gate 2006 - 1-Mark]

Solⁿ $\tan \theta = \frac{L_{40} - 50}{60} = \frac{100 - 50}{100}$

$$L_{40} - 50 = \frac{1}{2} \times 60$$

$$L_{40} = 30 + 50$$

$$L_{40} = 80 \text{ dB}$$

- Noise limit as per noise pollution rules 2000 of India -

Area/Zone	Limit in dB Leq (Day time)	Limit in dB Leq. (Night time)
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40